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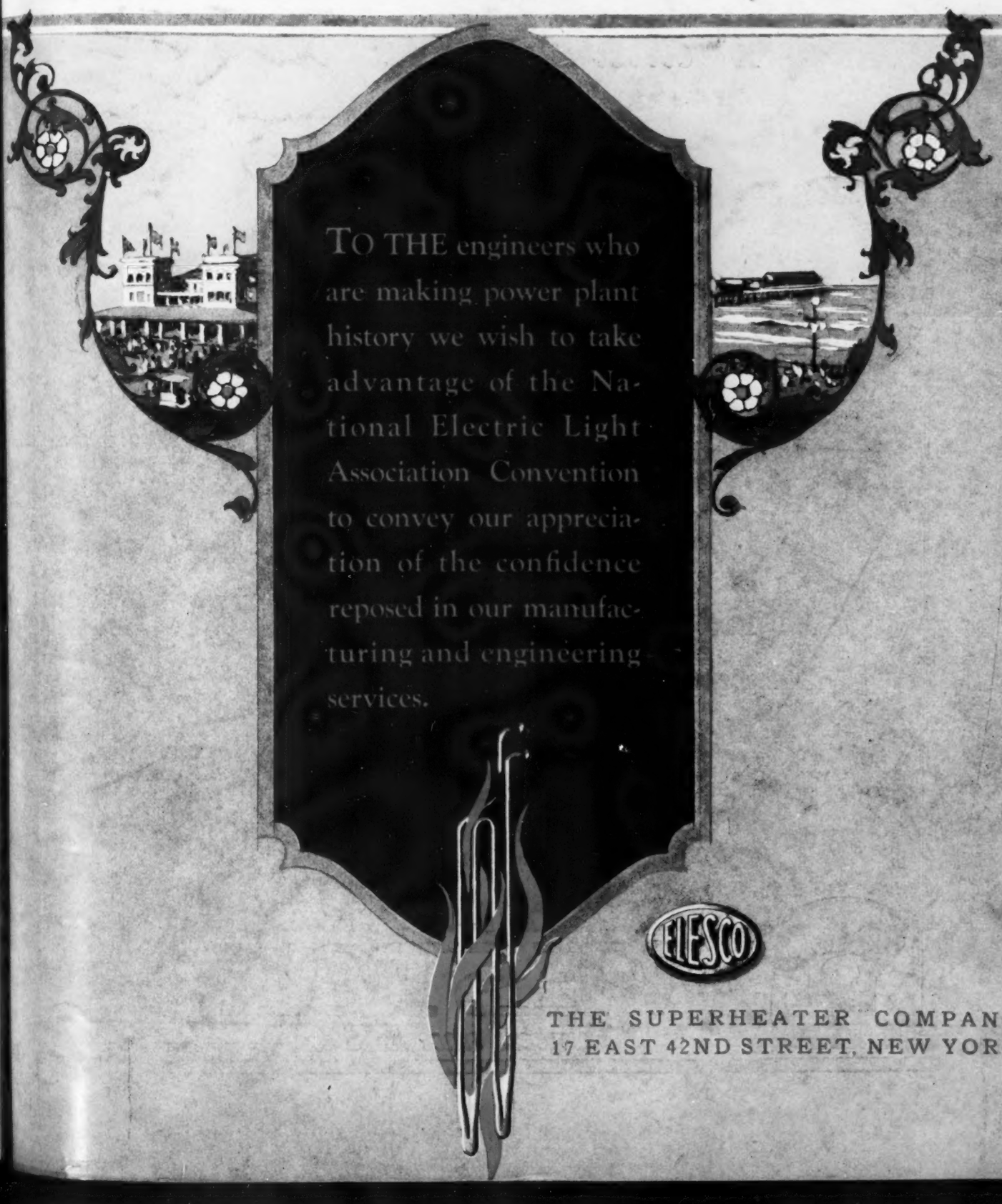
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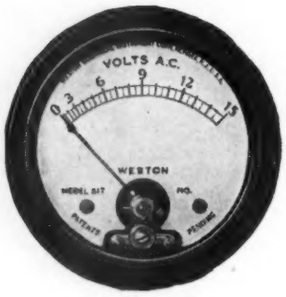

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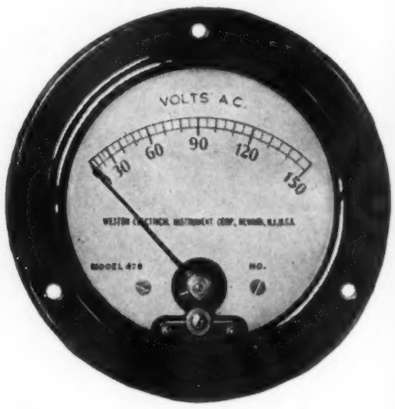

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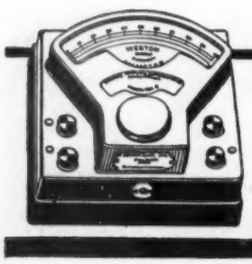

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Vol. 89, No. 23 New York, June 4, 1927 Pages 1181-1232

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Ave. at 36th St., NEW YORK, N. Y.

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NEW YORK Dist. Office, 285 Madison Ave.
WASHINGTON, Colorado Building
CHICAGO, 7 South Dearborn St.
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ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie Street, London, E. C. 4

Cable Address "Machinist, N. Y."
The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Haiti and Paraguay. Extra foreign postage, $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.
Change of address is Address — When change of ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Copyright 1927
By McGraw-Hill Publishing Company, Inc.

Published weekly
Entered as second-class matter Jan. 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Circulation of this issue, 19,500

Publishers of
Engineering News-Record — American Machinist
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal
Ingeniería Internacional — Electrical Merchandising
Bus Transportation — Electric Railway Journal
Electrical World — Construction Methods
Industrial Engineer — Radio Retailing
Electrical West
(Published in San Francisco)
American Machinist—European Edition
Published in London

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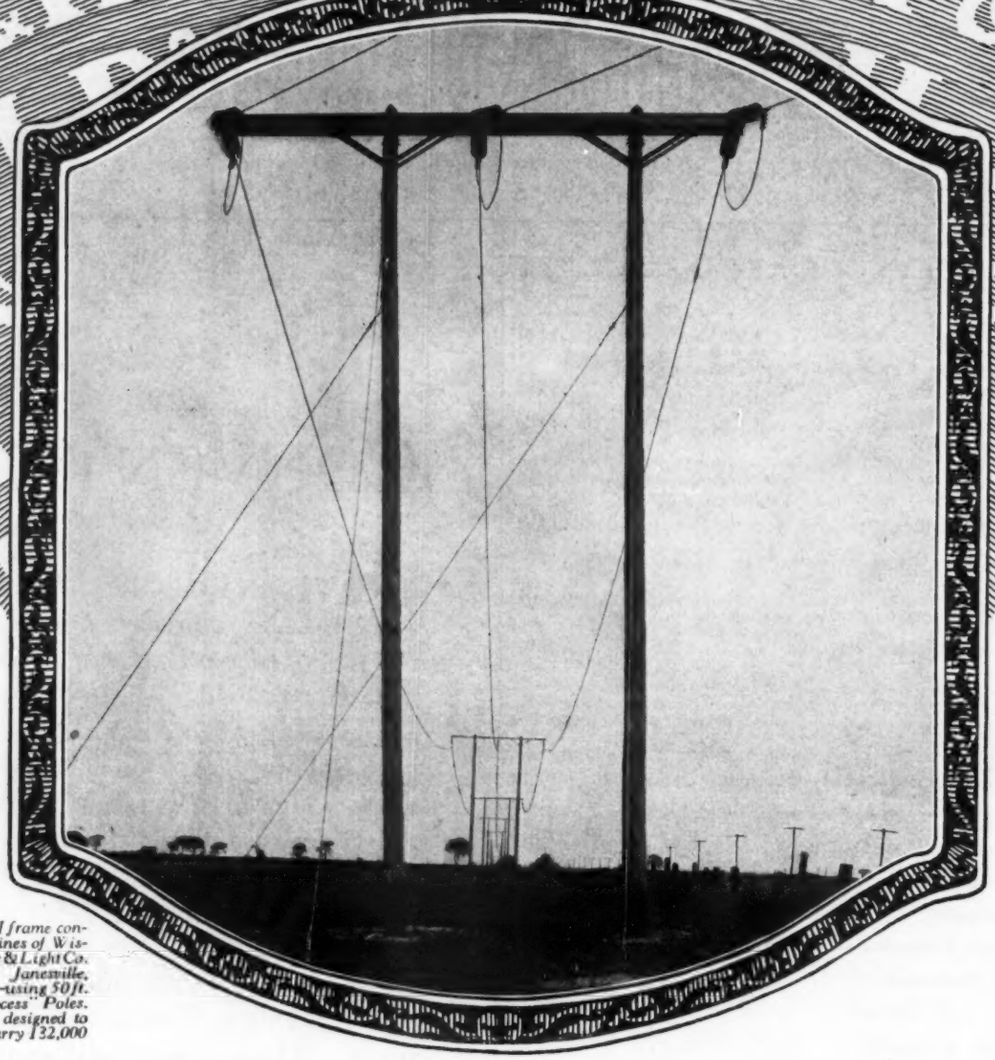
Covering the CONVENTION

IN ATLANTIC CITY during the N.E.L.A. convention the editorial staff of the ELECTRICAL WORLD has its peak load. While utility men attend meetings and enjoy association with old and new friends, the editors work under high pressure to get out the Convention Daily and the Convention Report Number of the ELECTRICAL WORLD.

The convention closes Friday noon, and on Saturday morning copies of the ELECTRICAL WORLD will be in the mails. These copies will contain a detailed report of all happenings at the convention and, in addition, editorial interpretations of the meetings and of the trends there made evident.

MANY editors, each with years of experience, a large and well-manned publishing house and an organization which is accustomed to do big jobs make possible this service to the light and power industry. The editors are ready for their peak load and have all reserves ready for action. They welcome this emergency test of their service competency.

Advertising Index—Alphabetical, 90; Classified, 84, 86, 88; Directory of Engineers, 36, 37; Searchlight Section, 38-43



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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, June 4, 1927* — NUMBER 23

The S. E. D. Effects a Reorganization

REORGANIZATION of the Society for Electrical Development, an accomplishment just announced, will be acclaimed throughout the electrical industry. It has followed the logical and necessary course of establishing a close practical relationship between the S.E.D. and the four major national associations by the simple expedient of electing to the board of directors of the society the presidents and managing directors of the National Electric Light Association, the National Electrical Manufacturers' Association and the Association of Electragists and the newly elected chairman of the executive committee of the Electrical Supply Jobbers' Association. When the jobbers appoint their new managing director he will also be on the society directorate. One other representative will be suggested by each of these four associations. The third representative of the N.E.L.A. will be the chairman of its Commercial Section.

As new presidents come into office in the four associations, they will succeed also to membership on the board of the S.E.D. Automatically, therefore, the directorate of the society becomes an informal council of the industry in which the men responsible for the operation of the national associations of the power companies, the manufacturers, the jobbers and the contractor-dealers become also responsible for operating this co-operative institution which the industry has been maintaining to carry forward its promotional and publicity activities. It is a splendid arrangement—simple and workable.

So far, so good—and the industry waits eagerly to hear that the other two steps have been taken that are needed to set up the society on the plane of usefulness where all desire to see it. First, the industry must refinance the S.E.D. and stand it squarely on its feet as a sturdy body and one able to serve adequately. Second, a managing director must be put at the head of this organization who will challenge the respect and confidence of all groups of electrical men and assume a place of leadership in this new council of the industry. For the day of the market builder is at hand.

Blast the Commercial Levees

CONSTRUCTIVE dissatisfaction characterizes an industry which is in a healthy condition. For growth and prosperity come from the commercial exploitation of human desires for something better. Electrical men have done big things but are not content to rest upon their laurels. They are seething with purpose and fret with impatience because they cannot immediately grasp their opportunities.

Electric service as measured in terms of energy and devices is only embryonic in this country. Recent studies of the homes and factories show that a state of maturity in service would dwarf present standards of accomplishment. The market is here and electrical men are ready to exploit it. Selling is the present keynote for industry progress, and selling is the industry problem that must be faced and solved. Any commercial success is based chiefly on an understanding of human nature. Success in electrical selling is obtained by measuring the innate dissatisfaction of customers with what they have and in the capitalizing on this discontent by selling them satisfaction and more satisfaction in terms of electrical energy and electrical devices.

The automobile industry has developed selling sense. It is commonplace for customers to buy new cars each year, and many sane persons buy a new model every six months. The automobile salesmen have convinced customers that the purchase of something new or better is evidence of an appreciation in their intelligence and not evidence of a depreciation in their bank balances. The electrical industry needs this kind of selling talent.

Co-ordinating Engineering Work in Holding-Company Subsidiaries

FOLLOWING the acquisition of local utilities by holding-company or centralized management groups, question often arises as to the scope of local engineering activity desirable under the new régime. Two extremes of policy seem to be developing, one favoring the transfer of all engineering except operation to the headquarters organization, the other encouraging local initiative and resource to the limit and using the technical staff of the managing company for advisory and review purposes only. The solution, however, is not so difficult as the above divergence might indicate. Present experience shows that every company manifests an individual problem to be studied from the standpoint of rendering the best engineering service at the lowest ultimate cost to the local situation. The smallest companies require at least a modicum of engineering skill in their local administration, even where there is nothing but a substation and distribution system to operate. The intimate knowledge of the situation possessed by local technical men can never be safely thrown aside by any headquarters group of engineers, regardless of their ability. Therefore it is apparent that well-rounded designing and first-order construction work should include proper co-ordination of thinking between local and headquarters staffs, but the extent to which responsibility should be allocated depends on the size of the local company, its resources, experience and conditions of territory and system, as well as upon the caliber of headquarters engineering ability available to subsidiary or managed properties.

On a large property under holding-company management it is not unusual for an engineering staff of marked ability to have been developed during the years of "lone-hand" administration. In a typical case the headquarters staff recognized this local ability sufficiently to leave the lion's share in designing and building a hydro-electric development costing some five millions of dollars to the local engineers. The plans were sent to headquarters and checked against the experience of the holding-company men before construction was pushed. The result was a highly economical and excellent job, and doubtless this method will be followed as long as the local organization shows its capacity to handle such problems with such competence. On the other hand, within a few hundred miles may be found a system on which the policy is to turn as much work as possible over to the management organization, leaving the local technical staff to concentrate most of its energies upon operating problems. In all such cases the benefits of co-ordinating experience through the holding-company staff and by circulating ideas and encouraging meetings between engineers of different properties are coming to be recognized. It goes without saying, perhaps, that local and headquarters engineers alike are in a position to give each other aid that cannot be obtained without co-operation, and the need of the present situation is more complete analysis of the cost and results of engineering activities at both ends of the line. Given reliable data of this sort, the decision will be easier and more accurate in specific cases as to what extent to build up engineering nuclei on subsidiary properties and the proportion of engineering activities which can best be handled at headquarters.

Engineers, Get Into the Game!

MANY engineers in the utility industry have a tendency to withdraw into their technical shells and let the rest of the industry go by. If they injured only themselves by this modesty or indifference, no comment would be necessary, but they injure the industry they serve. They, more than any other group, are responsible for the mammoth electrical organism which serves this country. They have the background of knowledge, the training in analytical thought and the imaginative conceptions of scientists, else they could not have built the physical structure of the industry. The engineers, indeed, are in duty bound to contribute to utility management policies. They should act and present development plans and business policies to their executives. There is too much tendency on the part of engineers to be afraid of industry executives, too much tendency to talk among themselves, too great a tendency to criticise executive policy plans after executives have acted. All the thoughts and plans of engineers for the good of the industry accomplish nothing unless brought to the attention of executives. How many engineers' names will be found on reports or articles dealing with fundamental industry policies or management plans? The most competent group of men in the industry have least to say, even though these plans and policies deal with engineering conceptions only.

But many engineers fail to realize also that the human and social aspects of the light and power business and the elements that go into commercial success are essential and fundamental factors in their industry. Management and commercial problems are big problems with ramifications which reach into every nook and corner of the business. Other engineers, who do realize this situation, fail to respond constructively and merely smile and say, "Why worry us with other people's problems?"

The industry needs engineering knowledge, engineering habits of thought and engineering perseverance to solve the human, management and commercial problems. Half the problems require statements made with the orderliness and logic characteristic of engineering, when the solutions will appear evident. The other half of the problems are so linked with engineering that an intelligent solution can be had only by aid of those who have basic engineering knowledge.

It is a strange condition to find an industry waiting with open arms for a group to come to its aid. The prizes in money and authority are hung in full view of observers. The need for action is urgent. What is the psychological quirk or the defect in training that develops inhibitions in most engineers to such a degree that they refuse to accept their executive responsibilities?

For Whom Does the Industry Work?

COUNTLESS indeed are the public utility employees who have opened their morning newspapers during the past two or three years to find that almost overnight, as it were, the control of their companies has passed into new hands. Often these changes have been accompanied by internal unsettlement, as they have been forecast, and unrest among executives has induced mental uneasiness down the line, with resulting lack of smoothness in the conduct of company affairs. Still worse have been the anxieties associated with financial battles occasionally fought for control, and the splitting of old organizations into factions, with corresponding newspaper publicity as events have ebbed and flowed, has disturbed the normal routine of daily work even to system frontiers. Service has been maintained much as usual, but lost motion has increased and a very wet blanket has at times been thrown over planning and developmental activities. Indefinite but substantial losses have occurred through impairment of the customary team play, and initiative has unquestionably suffered among individuals.

We are still in the midst of a transition period in utility control whose end no man can foresee in detail. The tendency toward centralization of management is bound to continue for a long time, and even the formation of investment trusts cannot change the trend of the times so long as the public is willing to pay the price of acquiring desirable properties and grouping these into controlling organizations of high caliber. So long as the controlling owners of particular properties refuse to sell at a price, the properties will remain intact, and only so long. Now, it would be well for more employees to realize that the sale of a public utility property is in itself a perfectly legitimate transaction, and also that the entire light and power industry is working for the general public and not in the final analysis for the group of bankers who may for the time being control this or

that aggregation of securities. No matter who controls the power company in X or Y, local service must go on and expand indefinitely; pay envelopes must be regularly filled; rates must be fairly regulated from the standpoints of both the customer and the investor, and the organization must function in a businesslike manner. The impact of new methods and of new personalities must be met as control changes, to be sure, but this is often very wholesome for the personnel. Fortunately for the rank and file, it works out in innumerable cases that the old leaders are retained and valued by the new owners, provided that such executives are open-minded and adaptable to new ideas; and frequently new doors of opportunity are thrown wide. The realization by every man and woman in utility work that he or she is engaged in an indispensable public service and that, by and large, new owners are interested to discover ability in the personnel of local properties should go a long way toward stabilizing the minds of such employees during the present era of change.

Opportunities for Installing Equipment for Commercial Lighting

MANY satisfactory fixtures are available for commercial illumination consisting of a ceiling fitting or a single pendant supporting an inclosing unit of diffusing glassware. A few other designs may also be included in this group, which solves most of the lighting problems in many fields, such as stores, offices, schools, drafting rooms and hotel rooms. There has been no general campaign to promote store or office lighting such as the activities in residential and industrial lighting. Perhaps it might soon be advisable to enter these fields in an organized manner.

Some central-station companies have conducted successful campaigns in store lighting which show that the possibilities are attractive. For example, by an intensive effort extending over a few weeks one company sold five thousand commercial-lighting units which increased the connected load about 200 per cent and the annual revenue about $46,000. The method of trial installation was used. Customers were seen to carry merchandise to the relighted area of the store for inspection. For many obvious reasons the trial installation sold itself and the remainder of the lighting, if the entire store was not included in the trial. The success of this campaign did not depend upon selling to relatively few large stores. In fact, for the most part, small stores were visited and the average lighting units per order were less than three.

Dealers and individuals can also do a good business in the field mentioned, as has been adequately proved by those who have developed initiative and system for cultivating it. One of these, for example, has found that an early visit during the design of a building—or the rehabilitation of one—pays very well. He begins with the blueprints in the office of the architect or other supervising or designing authority. He submits a simple lighting layout and a photograph or sample of the standardized fixture. By properly "following up" he obtains much of this business. But he does a good job for lighting as well as for himself, because in many instances he is able to convince builders or architects that more outlets are necessary for good lighting than were provided on the original drawings, as well as to bring about their better location. This is an excellent field for central-station companies and contractors.

Industry Conference Reports on the Cost of Wiring

THE industry conference on wiring, in which the four major associations of the electrical industry participated, has published its report. The National Electric Light Association had charged that the Association of Electragists, by promoting its so-called "all-metal standard," was in effect restraining the development of the electrical industry through the high cost of wiring. The purpose of the conference was to determine whether or not high cost actually is discouraging the installation of wiring and to end the controversy which the public complaint of the N.E.L.A. had stirred up. The report of the chairman, which was unanimously approved and adopted by this conference and is now being distributed broadly throughout the industry, did not sustain the charges. In fact, it says: "The fear of the N.E.L.A. that the cost of armored cable wiring as compared with knob-and-tube work is restraining the sale of wiring and the development of the electrical industry has loomed to a size out of all relation to its importance"; and again: "There is no observable obstacle to the development of this house-wiring market that intelligent, well-organized selling will not readily overcome."

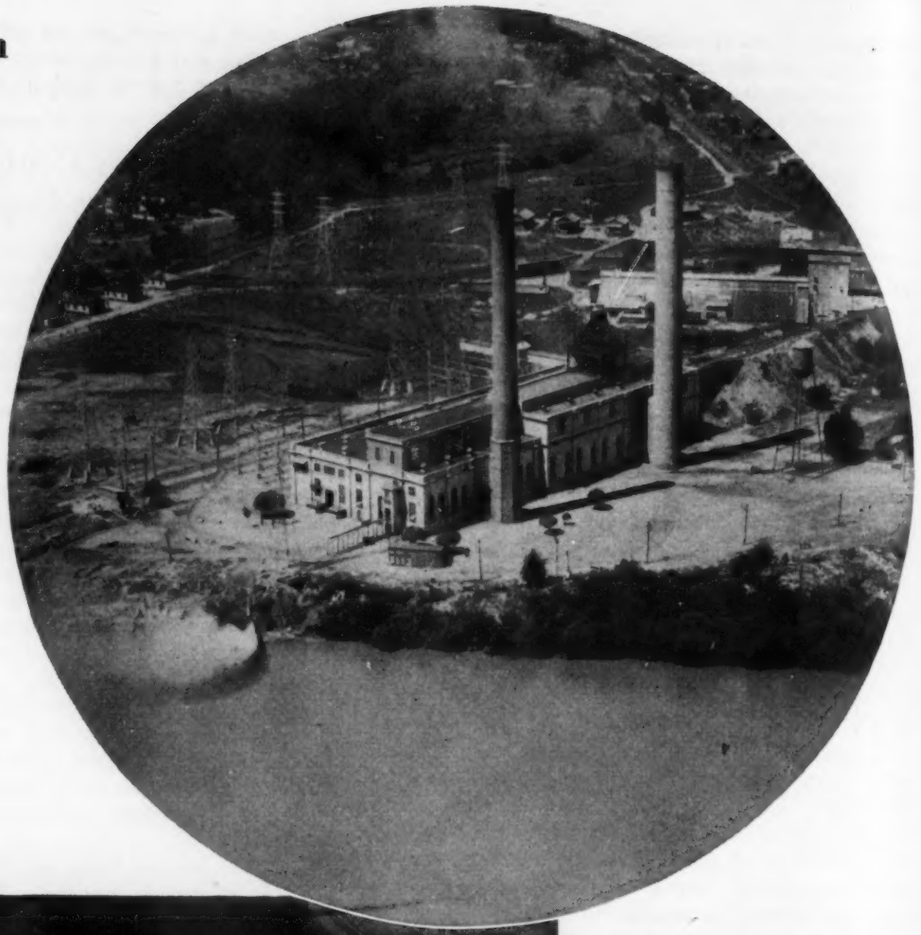
As in most such controversies, the trouble lay mainly in misunderstanding. The term "all-metal standard" is misleading, and the Electragists have agreed to avoid it hereafter in referring to their metal-wiring program. This program has not had the intent of inducing the installation of metal wiring always and everywhere, as many power company men have believed. Moreover, the difference in cost between armored cable and knob-and-tube work is apparently more in some places, less in others, with the average indicating some economy for knob and tube. But the report says: "It is doubtful whether this difference in cost is exerting any influence whatever on the sale of wiring."

If this conference had but discussed the controversy and settled the case with facts, its work would have been worth while. But it has done more than that. It raises the question: What *is* restraining house wiring? And it proceeds to contrast the opportunities for reducing cost with the opportunities for doing a better selling job. "Nothing is holding back house wiring," it says. "The trouble is—the pity is—that in this great industry no consequential effort is being made to push it forward." The report closes with a recommendation that each of the four associations appoint new delegations of sales executives to meet and formulate a program for the promotion of the market for house wiring and equipment, to be participated in by all branches of the industry properly co-ordinated.

Here is something to think about. It is an industry problem, this house-wiring situation. Close on to sixteen million inadequate installations are today checking the market for everything electrical. Action is needed. No one organization in the industry at present can cope with it. But the four major branches of the industry in joint conference could lay down a program. The recommendation deserves support.

Steam Generation for Transmission System

MANY extended transmission systems use a combination of steam and hydro generating stations. Such a system is the Southern Power Company, which serves a large industrial area in the Carolinas. Two typical steam stations belonging to this company are here shown. Both stokers and pulverized-fuel equipment are used.



THE principle of design is to have simple unit stations with the generators and three-phase transformers considered as an entity to supply 110,000-volt lines. The steam plants are used in dry seasons as aids in storing and controlling water to give maximum economy in operation of the system, as standby reserves and as generating sources for load areas. In most cases a steam plant is operated under full-load conditions at high load factor so as to produce steam power at minimum cost.

Forecasting Utility Growth

Steps in the Development of a Plan for Building a Light and Power System on the Basis of a Balance in Engineering, Commercial, Financial and Operating Requirements

By L. W. W. Morrow
Managing Editor ELECTRICAL WORLD

THE financial returns are the final checks on a successful utility business. Detailed studies on loads, sales, public relations, construction programs, organization requirements and financial operations must be co-ordinated and evaluated in terms of dollars and cents. An executive plan for building a system in which the parts and the whole are weighed in financial terms is a business necessity, and this plan should cover estimates for ten years in the future.

The territory served and the possible load in the area is the starting point of any system plan. The rate at which this business can be had is a second essential fact to be determined. Successive steps then measure the construction program, the organization requirements, the money needed to build the system and finally the gross revenues, expenses and net revenues that will be available each year. The rate of system building must be based on yearly operating profits and not on the achievements that might be recorded if all organization efforts are concentrated on any one plan of operations.

MARGIN BASIS OF FORECASTING

After territorial data, sales data from load surveys and other items are found which give a conservative estimate of business possibilities, a major problem is to predict the net earnings that will be available if the system is developed at the maximum rate determined to be possible. A pessimistic prediction may result if the present and past operating data are extended ten years into the future on a trend basis. An optimistic result (probably) would be obtained if gross income estimates from load surveys were used and estimated expenses were subtracted from the gross revenues. A normal estimate should consider some acceleration in the selling rate and some reduction in the expenses per unit of energy sold.

A method of forecasting net earnings developed by one public utility company has proved to be very accurate in practice. This method is based on the relationship between earnings and expenses and the hours use of system demand. From present and past data gross revenue per kilowatt-hour sold and classified expenses per kilowatt-hour sold are plotted to hours use of average system demand per year for each class of business served and for the total system business (Fig. 1). The margin between gross revenue and total costs for any value of the average system demand is the sum the utility has proved can be realized for the class of business considered. This marginal sum is then used in connection with predicted sales to arrive at the earnings that may be expected. The marginal estimate basis eliminates any necessity for considering future rate changes or variations in expenses in arriving at the total net earnings and surplus. It also has

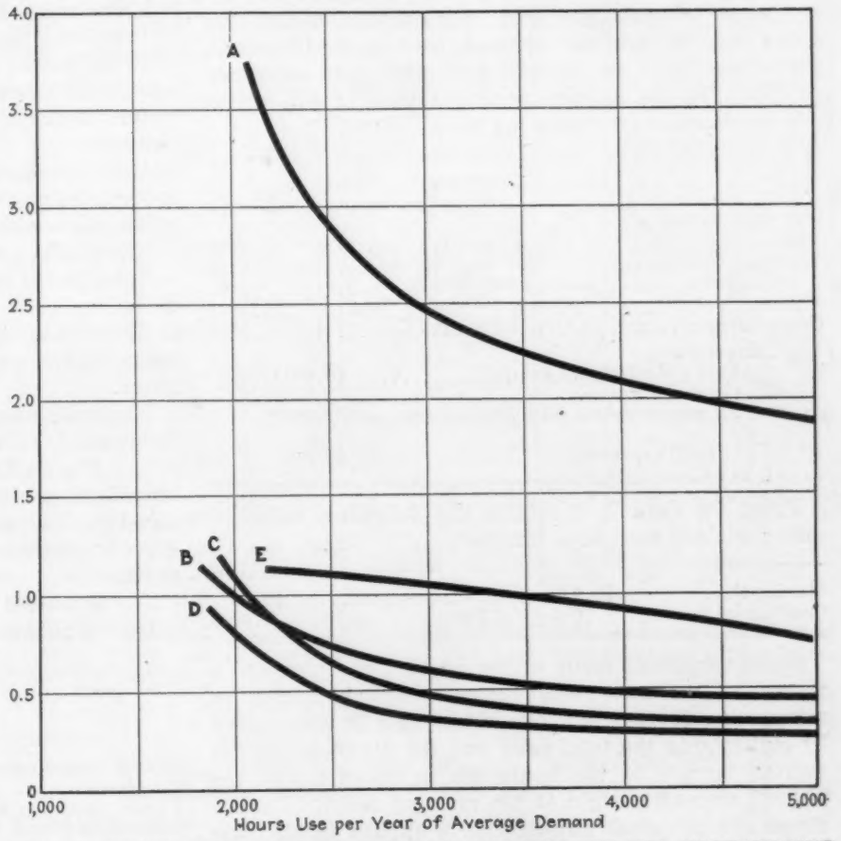


FIG. 1—RELATIONSHIP BETWEEN EARNINGS AND EXPENSES PER KILOWATT-HOUR SOLD AND HOURS USE OF AVERAGE DEMAND FOR ONE CLASS OF BUSINESS

A = Gross revenue per kilowatt-hour sold.
B = Cost of fuel and purchased energy per kilowatt-hour sold.
C = Other expenses, excluding reserve per kilowatt-hour sold.
D = General expenses per kilowatt-hour sold.
E = Over-all margin per kilowatt-hour sold.

Table I—Method of Showing Net Earnings Available for Return on Investment as Estimated

Sales	Margin	1927	1928
Municipal	$0.035	$164,000	$172,000
Commercial	.045	915,000	1,000,000
Domestic	.060	1,155,000	1,260,000
		$2,234,000	$2,432,000
Power and other companies	$0.0045	$2,490,000	$2,704,000
Net before correction		4,724,000	5,136,000
Correction for hours use of average demand		249,000	67,000
Net earnings available for return		4,973,000	5,203,000
Hours use of average demand		3,750	3,850
Over-all margin hours use		0.0089	0.0086
Basic over-all margin		0.0085	0.0085
Total sales correction margin		0.0001	0.0001

advantages in that the utility has demonstrated its ability to earn these marginal sums on each class of business regardless of load conditions, fuel prices, business fluctuations and labor disturbances.

The unit values of margin of earnings over expenses are found by taking the hours use of the average demand during a number of twelve-month periods over the past years and the corresponding earnings and expenses per kilowatt-hour sold. For example, assume the hours use of average demand over a twelve-month period was 3,919 and records give other data necessary to determine the margins per kilowatt-hour sold, which are tabulated in the following table:

	Gross Revenue	Total Expenses	Margin
Class of Business:			
Municipal	$0.0493	$0.0141	$0.0352
Commercial lighting	.0593	.0141	.0452
Domestic	.0775	.0141	.0634
Power	.0186	.0141	.0045
Gross earnings	.0226	.0141	.0085
Expenses:			
Fuel and purchased energy		$0.0072	
General expenses		.0031	
All other expenses, including replacement		.0038	
Total expenses		$0.0141	

From the data in the table the following marginal unit sums are used in a forecast:

Municipal	$0.035	Domestic	$0.06
Commercial lighting	.045	Power	.0045

Since variations occur in the hours use of demand a correction in the net returns may be made by adding or subtracting further amounts, which can be determined by multiplying the total sales and the difference in the over-all margin at the hours use in question and the $0.0085 over-all margin at the starting point. Table I shows the marginal estimate basis applied in an illustrative example. In essence the marginal estimate basis of prediction thus uses an accelerated system rate of selling energy and a margin of net earnings for kilowatt-hours sold for various purposes which is the same value as has been earned during past years under similar demand use conditions. It has been applied in the preparation of a ten-year estimate and found quite accurate for use in making system predictions.

Once the margin curve *E* (Fig. 1) is found for any class of business, the annual load factors, gross revenues and other basic data needed for the final balance sheet can be worked out readily.

Territorial Data Needed

Before any system plan is made there must be had an estimate of kilowatt-hour sales, changes in system demand and the extent of territory to be served in the future. Industrial conditions, social conditions and the distribution and trend in population in the territory should be studied carefully and data tabulated. Typical facts of importance are:

Value of farm land per acre.
Kinds of crops and their value.
Value and kind of live stock products.
Number and kind of manufacturing plants.
Investment value of manufacturing plants.
Value added to raw materials by manufacture.
Population per square mile.
Prime mover rating in manufacturing plants.
Annual increase in telephones.
Income tax analyses by classes and by magnitude of incomes.
Home dwellers, their expenditures and habits.
Ratio of utility customers to population.
Kilowatts of generating capacity per capita.
Kilowatt-hours used per capita.
Total power and utility power in kilowatts per square mile.

These data should include a period of at least ten years of the past and should be predicted for future years.

Examples of typical data for territories are given as follows:

(a) The kilowatt-hours sold per capita by five neighboring utilities in 1925 were 725, 690, 610, 550 and 410. The differences in these figures offhand makes a study necessary in order to find the reasons for the variations.

(b) A state-wide and a territorial survey by a utility gave the following data:

	State	Utility Territory	Per Cent in Utility Territory
Area in square miles	40,000	7,500	18
Population	6,000,000	1,000,000	17
Prime movers in manufacturing plants, kw.	2,000,000	800,000	36
Value of products added by manufacture	$2,000,000,000	$500,000,000	21
Value of crops	800,000,000	100,000,000	24
Value of live stock	150,000,000	40,000,000	20
Total	$3,000,000,000	$600,000,000	20
Value of farm land per acre	$90	$70	

Table II—Typical Data on Demand and Sales

	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	Ten-Year Estimate
Maximum demand, kw.	5,200	7,500	12,000	15,900	16,500	16,000	17,500	18,000	19,000	20,000	20,000	.....
Sales, kw.-hr:												
Municipal	475,000	475,000	635,000	650,000	675,000	700,000	715,000	735,000	735,000	755,000	795,000	6,890,000
Commercial	1,595,000	1,732,000	1,900,000	400,000	2,300,000	2,500,000	2,700,000	3,000,000	3,375,000	3,700,000	4,080,000	27,600,000
Domestic	1,760,000	1,928,000	2,000,000	2,100,000	2,200,000	2,300,000	2,400,000	2,600,000	2,700,000	2,800,000	2,990,000	24,100,000
Power	7,545,000	17,691,000	36,300,000	51,000,000	48,600,000	41,800,000	45,200,000	54,000,000	57,000,000	60,200,000	62,200,000	475,000,000
Total												533,590,000

The percentages shown in this tabulation afford opportunities for profitable studies, and if data are given for several years in the past, the trend of development helps determine the reasons for the difference in the figures.

(c) The change in the customers per capita on one system was one customer to every twenty people in 1920; one customer to every four people in 1925; one customer to every 3.8 people in 1930, and is estimated to be one customer to 3.33 people in 1935. The last two items are predictions and the 1935 figure represents a very high degree of saturation.

(d) Changes in sales of energy per capita afford interesting data. An example on one system is as follows:

	1921	1925	1930
Kilowatt-hours of domestic sales per capita	307	371	597
Kilowatt-hours of commercial lighting sales per capita	2,087	2,285	3,548
Kilowatt-hours of street-lighting sales per capita	18.7	20.6	34.7

(e) The annual increase in population for different territories in this country between 1920 and 1930 will vary from 2 per cent to 2.75 per cent, yet the long-trend curve of kilowatt-hour consumption per capita will show an annual increase of from 10 to 25 per cent, depending on the territory and the selling program of the utility serving the territory.

Load Data in Area Served

An important survey for any utility covers the load possibilities in the service area. Items of value in such a survey are as follows:

Distribution of population per square mile.

A map of the system and of other systems in the territory.

The prospective limits of the territory served.

An analysis of the market for utility service in detail, including

- The location of each market.
- The competition to be expected.
- The nature and intensity of development at present and expected.
- The power sources and possibilities for replacement of plants.

The methods of selling the market, including

- Wholesale sales opportunities.
- Acquisition of other properties.

Each of these items requires an intensive study and the development of data, most of which can best be presented in the form of maps, tables and charts. A very important study should be made to fix the ultimate territorial limits. This study is fundamental in the determination of the system plan and should incorporate a thorough study of interconnections with neighboring utilities. Interconnection possibilities in turn influence the power generation expansion plan and affect the location and capacity of the future generating stations. In competing or overlapping territory it is advisable to work out a co-operative development plan for the complete area, covering major interconnections, construction programs, energy interchange relations, location of major power stations and major service and public relations policies. Technical features of system design should follow, not precede, the broader economic and policy studies involved in intercompany relationships. The basic considerations for considering interconnections are continuity of service and reduction in fixed charges. Elements to be studied include diversity economics in generation, transmission and what might be called financial diversity in construction programs and in money-raising activities.

Technical System Data

A representative weekly load curve is found to be a good unit for measuring demands, outputs and load factors. Either an average based on annual figures or a representative weekly load curve for each year may be used. This series of curves may be plotted to study changes in system conditions and may be further subdivided into load curves for units or divisions in the system. With these load curves, with load curves of adjacent properties and with new business survey data, a load curve can be made for the completely interconnected system, for each subdivision and for each class of business.

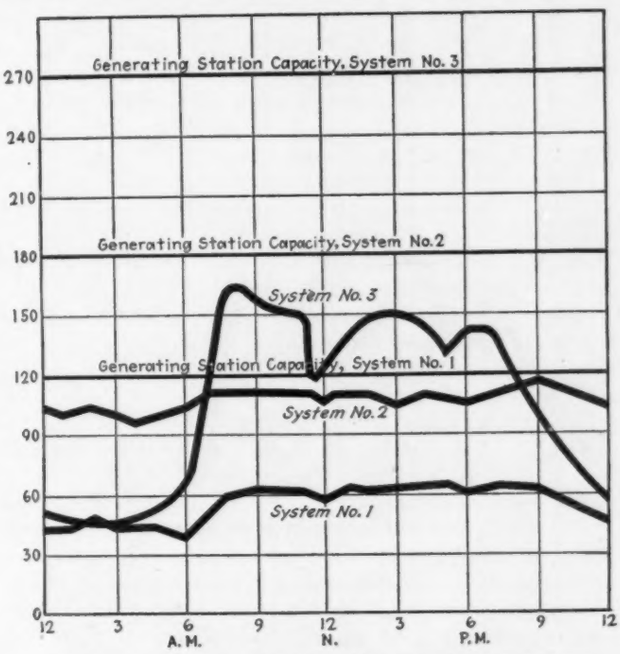


FIG. 2—POSSIBILITIES OF INTERCONNECTION VISUALIZED BY LOAD CURVES

Supplementary data on the system which can be charted to good purpose are:

Kilowatt demand to years.

Kilowatt-hour sales to years.

Hours use of maximum demand of system to years.

Classified kilowatt-hour sales to years.

Load curves for each year under maximum conditions.

Load curves of adjacent properties for each year under maximum conditions.

Generating station production costs to millions of kilowatt-hours sold each year.

Classified sales for each year in kilowatt-hours per customer.

Gross income for classified sales in cents per kilowatt-hour.

Net income for classified sales in cents per kilowatt-hour.

Gross income in cents per kilowatt-hour sold to hours use of system demand.

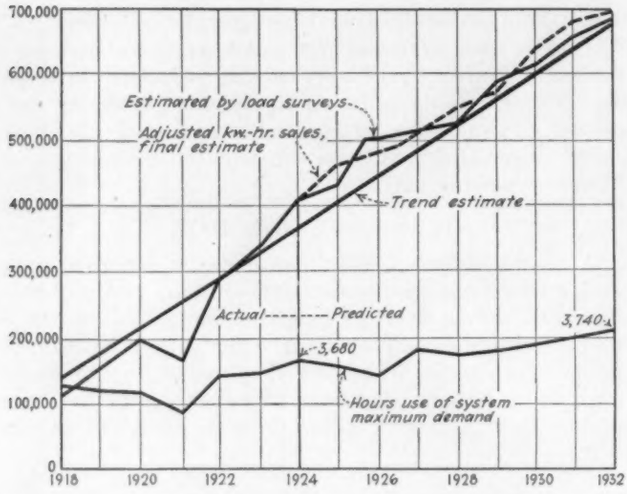


FIG. 3 — KILOWATT-HOUR SALES: BY TREND, BY LOAD SURVEY ESTIMATES AND BY ADJUSTMENTS OF LOAD SURVEY ESTIMATES; ALSO HOURS USE OF SYSTEM MAXIMUM DEMAND

Cost of fuel and purchased energy per kilowatt-hour sold to hours use of system demand.

All other system operating expenses per kilowatt-hour sold to hours use of system demand.

General or overhead expenses per kilowatt-hour sold to hours use of system demand.

Over-all margin in cents per kilowatt-hour sold to hours use of system demand.

FUTURE LOAD CONDITIONS

Present demands and the kilowatt-hour outputs for each unit of a system, for each class of business and for the whole system give important data whereby future conditions may be predicted. In each local area of a system, data for past and present maximum yearly demands and kilowatt-hour sales should be tabulated, and these data and detailed field investigations of demands and sales give basic information by which future predictions should be made. Predictions of value require that careful consideration be given to the trend of the growth in the business from past data and to the expectations for additional business as obtained from the load surveys.

System trend curves obtained from data on past operations presuppose the normal increase and will not take into effect any results obtained by intensified commercial efforts or changes in service territory. In effect, they presuppose the commercial development of business in the future will be at the same rate as in the past. On the other hand, detailed load surveys will show the possible loads for the system, but the rate of acquisition of these loads is a financial and commercial problem that involves a study of the expenditures necessary to get the business and the earnings that will be obtained. An adjustment must be made by using the two sets of data and certain modifying factors.

Sales in different classes of business should be obtained for past years, and major items in each class of business should be studied. The domestic load should be measured in terms of meters per capita, energy per customer, gross income per customer and net income per customer. In addition household budgets, social conditions and the effect of possible rate changes should be weighed. Then come a study of increased domestic service in terms of energy, merchandising, net income and sales organization.

The same type of analysis should be applied to commercial lighting, to sales to municipalities, to street lighting, to power sales, to railway sales and to sales to other utilities. For all classes of business the demands and the kilowatt-hours are important items, and consideration should be given to the value of the rate for service that will get the business and the increment growth that can be obtained each year with a full selling staff.

Graphs showing demands and sales for each class of business for the whole system for each area can be plotted from data obtained from operating records. These graphs should be extended for ten years in the future to give long-trend indications of future developments that are based on past experiences in operating the system. On the same graphs the demands and sales found from field surveys should be plotted to cover ten years in the future. The former curve is pessimistic and the latter optimistic, and an intermediate curve should be made which is determined by the use of modifying factors such as the effect of business cycles, cost allocation studies and local territorial conditions. This final prediction on demand and sales is the basic adjusted data to use in balance sheet predictions and to compute revenues to be expected by using the marginal estimate basis explained previously. Accompanying graphs and Table II give illustrative data.

BUSINESS CYCLE MODIFYING FACTORS

The national business situation is reflected in utility operations. It is well, therefore, to set up barometers based on data that give the general business trends in the past, and these should be extended into the future, even though general business cycles in this country cannot be predicted with accuracy. Past experience shows a range of from 26 to 50 months for these cycles, but these business barometers are useful to serve as guides for a few months in the future and for long-trend predictions. Barometers in this class are made from statistics of pig iron production, bank clearings, stock prices, money rates, railroad loadings, building construction permits and commodity prices. Other good utility business barometers are found in the use of data on the increase in population and in the kilowatt-hours generated. Useful and supplementary barometers are those

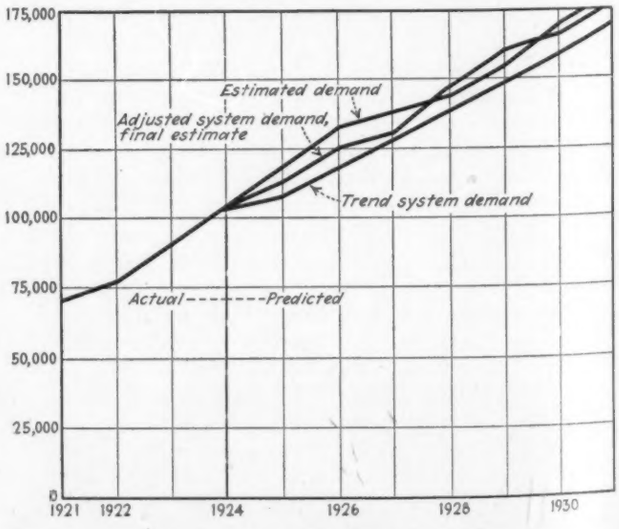


FIG. 4—SYSTEM DEMAND PREDICTIONS: BY TREND, BY LOAD SURVEY ESTIMATES AND BY ADJUSTED LOAD SURVEY ESTIMATES

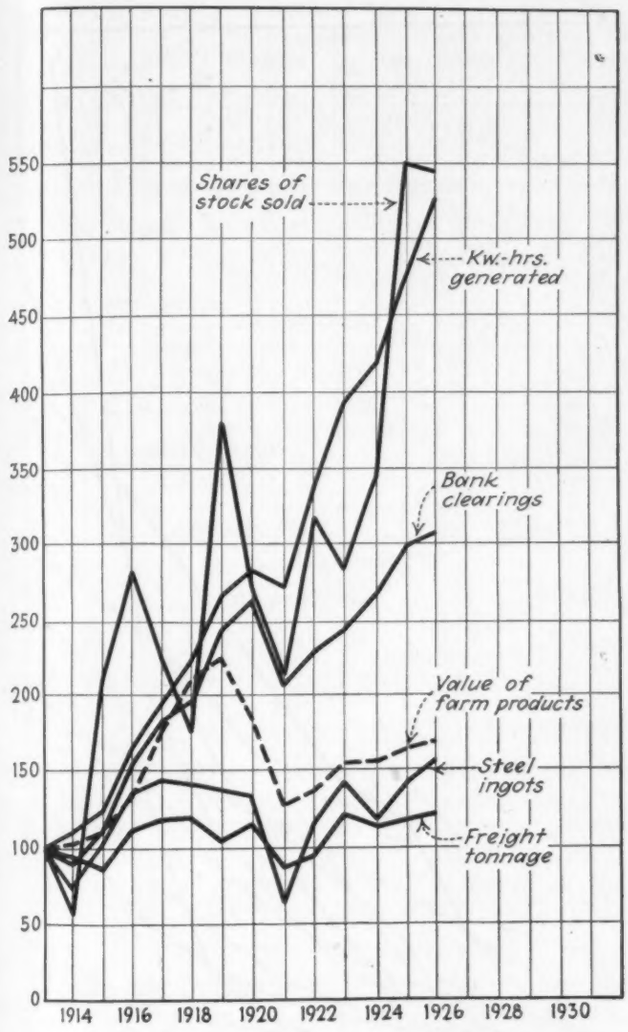


FIG. 5—TYPICAL NATIONAL BAROMETERS

concerned with the trends toward urban and rural dwelling, home building and apartment house building, the growth of population in representative cities and the growth of basic industries which are represented in the territory the utility serves. The extension of these barometers into the future can be made by the method of least squares, by means of logarithmic plots or by the use of a formula such as

$$R = \sqrt[n]{\frac{A}{P}} - 1$$

in which

P = amount at the beginning of the period.
A = amount at the end of the period.
R = rate of increase.
n = number of years.

Cost Allocations as Business Guides

A study of the present and past financial condition of the utility in terms of the business done is very valuable as a guide to direct executive efforts and to modify the predicted growth of the system. Such a study involves a cost allocation analysis in terms of classes of business served. This analysis is readily made on a utility system to the degree of accuracy required in a system-building program. The analysis should cover several years in the past in order to secure the trend indications and proportionate changes in classes of business.

The value of these analyses is found in the fact that they segregate the present investment; fix the cost of service, the investment and the returns for each class of service; determine the classes of service in which new investments should be assigned, commercial efforts should be accelerated or rate schedules adjusted; stabilize the net return on the whole system, because trends of class business can be guided, and enable future returns in classes of business to be predicted more accurately. For holding company executives cost allocations give a ready means of comparison of the activities of the different properties and afford useful data for rate cases or other regulatory analyses.

The utility balance sheet shows over-all results, but does not give details as to how earnings are divided among the classes of business served or show whether or not the revenue and earnings for each class are equitable. Nor do balance sheets show details of where the earnings are coming from over a period of years, where the growth in the business occurs or the proportionate increase in sales and profits for each class of business. If an analysis of a business shows some classes are not earning proper returns per customer, there is indicated a necessity to build up earnings in the class through greater sales, rate changes or other methods. If one class of business is increasing at a very rapid rate as compared with other classes, commercial efforts can be balanced to give a better proportion in sales. The sales, investment and profit trend curves obtained by cost allocation give the utility executive very accurate information about his business and enable him to direct system efforts. Any system can well afford to set up a cost allocation in terms of class business as part of its building program.

System Construction Program

With the load as the starting point, a method has been given whereby data have been collected and studies have been made that give the demand, the kilowatt-hours and the hours use of demand to be expected in future years. These data are detailed as to classes of business and as to the location of the loads on the system. The next step is to determine the utility construction program and the cost involved in getting this business.

Generating station capacity, the location of stations, the construction program and the costs involved are

Table III—Method of Showing Income Statement Estimates

	1927	1928
Gross earnings	$12,789,000	$13,207,000
Operation and maintenance	7,147,000	7,651,000
Net earnings available	5,203,000	5,556,000
Replacement expense	1,113,000	1,166,000
Net earnings	4,090,000	4,390,000
Bond interest	1,708,000	1,708,000
Interest on current liabilities	36,000	39,000
Interest on replacement reserve	200,000	227,000
Bond and discount expenses	97,000	97,000
Total interest	2,041,000	2,071,000
Net profits	2,049,000	2,319,000

Method of Showing Cash Estimates

	1927	1928
Gross earnings	$12,789,000	$13,207,000
Net earnings	4,090,000	4,390,000
Net profits	2,049,000	2,319,000
Preferred stock dividends	645,000	687,000
Replacement reserve	634,000	692,000
Bond discount	97,000	97,000
Bonds sold at 91	1,820,000	
Preferred stock sold at 90	540,000	540,000
Notes payable	.....	.....
Construction	1,500,000	1,215,000
Net cash available	2,995,000	1,746,000

matters of local system determination from a study of the predicted load data and demand data. Interconnection possibilities, suitable plant sites and construction plants of neighboring utilities are influential elements; but on a given system it is possible to determine the capacity to be added, to determine its location and to compute the capital expenditures required. The capacity to be added can be found by using the long-term trend as indicated by past operations after modifications have been made using the studies and data already tabulated for the system.

The kilowatt-hours expected to be sold should have added to them the system losses to arrive at total generating requirements.

A more or less detailed technical and economic analysis is needed to determine the layout of the future transmission lines, substations and distribution system. The local territory load prediction data fix the magnitudes of the capital investment required and long-term data can be used to give the rate at which capital and plant additions should be made if the system follows the predicted growth. In some cases the average expenditures for the past five years can be used as a basis for estimating miscellaneous capital requirements; but if the system is to be expanded greatly, if underground installations are to be made, if transmission lines are to be built or other major changes are to be made, detailed estimates should be made.

Basic Financial Data Require a Valuation

A valuation report on a system gives the necessary financial data to afford opportunity for measuring the future in terms of total investments and returns. It is advisable that a system valuation be subdivided into generating stations, transmission lines, high-tension substations and distribution system, and in some cases a division into depreciable and non-depreciable property is warranted.

A second financial tabulation is concerned with balance sheet data for the past years, a tabulation of the financial structure in terms of securities outstanding and authorized and a compilation of capital obligations.

Following the estimate of gross earnings by the marginal method a tabulation of gross earnings per dollar of investment should be made for each year in the future. This tabulation should be checked against data on past operations and the long-term trend estimate based on the past operations. If the investment per dollar of gross increases from, for example, $3 to $6 in a ten-year program, a danger signal is indicated.

Table IV—Financial Analysis for System Plan
Showing Method of Studying Securities and Their Controlling Factors

	1927	1928
Net earnings	$3,177,000	$3,496,000
Bond interest allowable (usually ½ above)	1,598,000	1,748,000
Bond interest as estimated	1,574,000	1,694,000
Bond interest earned (number of times)	2.02	2.06
Unbonded construction, previous years, brought forward	$3,845,000	$1,787,000
New construction	1,391,000	1,500,000
Construction available for replacement fund and bonds	5,236,000	3,287,000
Construction financed by replacement fund	116,000	121,000
Construction available for bonds	5,120,000	3,166,000
Construction on which bonds are drawn	3,333,000	2,666,000
Unbonded construction—forwarded	1,787,000	500,000
Bonds outstanding at beginning of year	22,458,000	24,958,000
Bonds drawn	2,500,000	2,000,000
Bonds outstanding at end of year	24,958,000	26,958,000
Property valuation at end of year	38,976,000	40,476,000
Net assets	14,018,000	13,518,000
Bonds outstanding—per cent of valuation	63.9	66.7
Preferred stock outstanding at beginning of year	$8,700,000	$9,200,000
Preferred stock issued	500,000	500,000
Preferred stock outstanding at end of year	9,200,000	9,700,000
Preferred stock—net assets per share	152	152
Net profits	$1,589,000	$1,731,000
Preferred stock dividends	628,000	663,000
Net to common stock	961,000	1,068,000
Preferred stock dividends earned—number of times	2.53	2.61
Common stock outstanding	$5,000,000	$5,000,000
Return on common stock—per cent	19.32	21.36

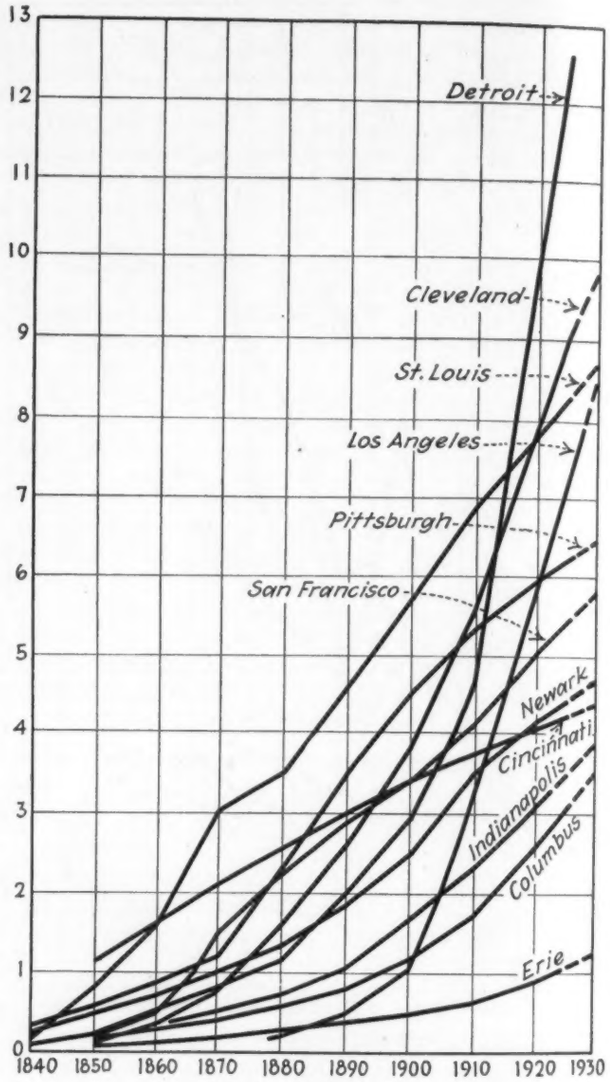


FIG. 6—GROWTH CURVES OF REPRESENTATIVE CITIES

Operating and Maintenance Expenses

The operating and maintenance expenses may be computed quite accurately. The cost of coal and the cost of coal handling at different stations should be tabulated. The kilowatt-hours necessary to generate each year may be determined by using the kilowatt-hour sales estimates and the low estimates with modifications for the kilowatt-hours from interconnections that have been forecast.

The production cost of energy should be arrived at by plotting the pounds of coal per kilowatt-hour for each of the generating stations to be used. This plot should be made as a function of the capacity required at each station. From the system and station demand estimates used in load prediction data the generating capacity required each year can be determined. From this item and the probable annual hours of operation the capacity factor is obtained. This fixes the amount of coal per kilowatt-hour of generation. To the cost of this fuel is added the operating and maintenance costs, which

can be obtained by using past costs per kilowatt-hour. A cost item should be included which is a constant cost per kilowatt-hour sold to represent costs other than generating. The total cost thus derived is used to compute the net revenue in conjunction with sales and margins as previously outlined.

REPLACEMENTS AND RESERVES

Many methods have been used to set up a replacement and reserve fund, including a small percentage of gross revenue, a percentage of the depreciable property or a

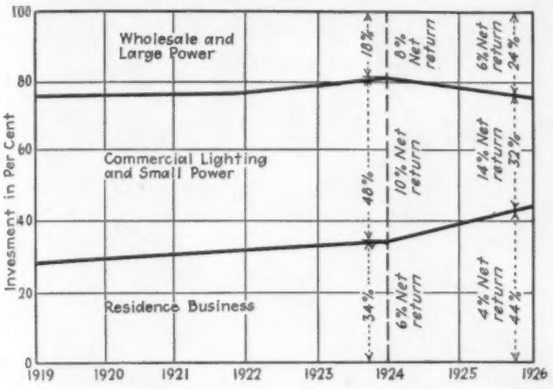


FIG. 7—COST ALLOCATIONS SERVE AS BUSINESS GUIDES

sum fixed by studies of the life of detail equipment. The object is to set up a fund that will enable the utility to write off the books property that has been renewed, replaced or abandoned. In some cases mortgage requirements of 10 per cent of the annual gross earnings are stipulated to set up this fund.

NET EARNINGS CHECK PROGRAM

Predictions for sales of energy, gross income, new capital expenditures and costs per unit of energy having been made, the last step in a plan is to find the net earnings and the sum available each year for surplus and dividends. This step checks the commercial merits of the utility building program heretofore developed.

Having total gross earnings, the increased capital expenditures required, the operating expenses and the margin available over all expenses for each year of the next decade, the utility executive can then survey the future accurately. He can check movements and can plan his program for raising capital for expanding his organization and for taking on load in conformity with a plan that has discounted guesswork to a great extent.

Table V—Method of Controlling Replacement, Reserve and Interest on Reserve

	1927	1928
Value of property at beginning of year	$31,716,000	$33,216,000
Replacement expense at 3.5 per cent	1,113,000	1,166,000
Probable routine maintenance	600,000	600,000
Maintenance and depreciation required by mortgage, 10 per cent gross	1,159,000	1,224,000
Excess spent and accrued*	554,000	542,000
Reserve balance at beginning of year	5,533,000	6,323,000
Interest at 4 per cent on average balance	236,000	268,000
Reserve balance at end of year	6,323,000	7,133,000
Increase in reserve balance	790,000	810,000

*This item is based on the assumption that routine maintenance and debits to replacement reserve will aggregate as much as the mortgage requires to be spent or set aside and the item represents an equivalent cash production through replacement reserve.

Change in Patent Office Practice Effected

A CHANGE in office practice in the United States Patent Office which will result in an important simplification of procedure, with resultant benefits to American industry and trade, was inaugurated on May 2. A reorganized Board of Patent Appeals has been established, as provided by an act of the last Congress, to function as the single patent appellate tribunal of the Patent Office and to replace the dual method of appeal formerly practiced.

The single Board of Appeals, which will comprise the Commissioner and the two Assistant Commissioners of Patents and the six examiners in chief, any three of whom will constitute a quorum of the new board, will eliminate approximately one-half of the procedure and time formerly required in appeals, according to government estimates, and will thereby reduce to that extent the congestion of cases. Another salient feature of the new act reduces the period within which the appeal must be made to six months.

The Patent Office is one of the branches of the government which is nearly self-sustaining. In the calendar year 1926 it received a total of 110,441 applications for patents, trademarks and designs and issued a total of 69,446. The receipts of the office from fees in connection with these services amounted to $3,449,700.

Swiss Railway Electrification Progresses

ELECTRIFICATION is virtually completed on the Lausanne-Berne line of the Swiss Federal Railways (61 miles), and electrically driven trains are now running on the Lausanne-Romont section (25½ miles). Between Lausanne and Romont the line rises 835 ft., and in spite of steep gradients an electric locomotive was able during recent trials to haul a 200-ton train at a speed of 40 miles an hour on the steepest section and at a speed of 50 miles an hour on the Palezieux-Romont section. The work entailed the widening of half a dozen tunnels and the reinforcement of several bridges. The conversion of the Lausanne-Berne section will mean the complete electrification of the Geneva-Berne-St. Maragrethen line linking France with Austria across Switzerland.

Table VI—Balance Sheet Estimates for Building Plan

Load Survey Data and Margin Basis

	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
Gross earnings	$7,000,000	$8,500,000	$9,500,000	$10,000,000	$10,700,000	$11,500,000	$12,000,000	$12,800,000	$13,200,000	$13,500,000
Net earnings	2,000,000	2,500,000	3,000,000	2,900,000	3,100,000	3,600,000	3,900,000	4,000,000	4,400,000	4,800,000
Replacement reserve	500,000	300,000	400,000	500,000	530,000	570,000	580,000	630,000	700,000	710,000
Net profits	1,000,000	1,000,000	1,500,000	1,200,000	1,500,000	1,700,000	2,000,000	2,000,000	2,300,000	2,500,000
Construction	3,800,000	3,700,000	3,200,000	1,400,000	1,600,000	1,200,000	1,400,000	1,500,000	1,200,000	500,000
Preferred stock dividends and bond discount	400,000	450,000	500,000	550,000	600,000	650,000	690,000	750,000	790,000	830,000
Bonds and stock sold	3,100,000	2,300,000	3,000,000	3,200,000	600,000	3,000,000	600,000	1,500,000	600,000	1,800,000
Notes payable	.....	700,000	700,000	.....	.....	.....	.....	.....	.....	.....

VERNON DAM STATION ON THE CONNECTICUT RIVER

New England Hydro Stations

Typical developments of the
NEW ENGLAND POWER ASSOCIATION
now one of the important holding companies in this region

DAVIS BRIDGE STATION ON DEERFIELD RIVER, VERMONT

Photos by Fairchild Aerial Survey, Inc.

Refinancing Effects Rigid Economies

Capital Structures Remodeled to Meet Business Requirements—Simplification, Open-end Mortgages, Balance in Issues and Saving in Capital Cost Advantages Sought

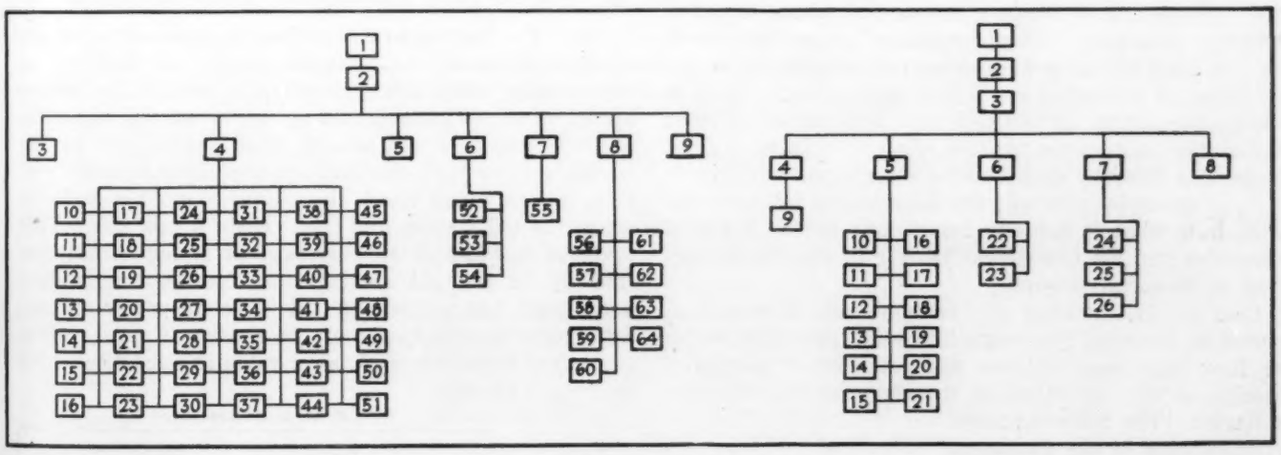
By H. M. Cameron
Financial Editor ELECTRICAL WORLD

IT IS TAKEN for granted that a utility executive should maintain the plant and equipment of a property at a maximum service efficiency. There is a parallel, often unrecognized, whereby the utility executive is faced periodically with the necessity of reconditioning the capital structure. A reduction of capital charges often permits an executive to make savings comparable with those obtained through engineering or operating economies, and the use of modern securities makes expansion possible more readily.

In the past decade utility operating and business conditions have changed radically. Each light and power company has had a very rapid growth, which has necessitated an enormous expansion in its financing and operating facilities. Under the stress of economies in operation many utilities have been merged or interconnected and there has developed the holding company for centralizing activities in management and finance.

Of necessity the rapid growth in business, the interconnection and mergers and the buying and selling of properties to get a better grouping of operating units have resulted in very complex and cumbersome financial structures. Older issues of properties were retained and new issues were offered when the opportunity arose to make advantageous purchases. An accumulated maze of issues often resulted that was confusing to the public and to the investor.

During the past year or two very active work has been done to clarify and simplify the complicated utility



OLD COMPLICATED CAPITAL STRUCTURE OF REPUBLIC RAILWAY & LIGHT AND APPEARANCE AFTER SIMPLIFICATION

Refinancing and remodeling of the Penn-Ohio Edison Company resulted in: (1) A reduction in the number of companies from 64 to 26; (2) the retirement of many old-form closed mortgage issues and the substitution of new type issues; (3) a large interest saving, and (4) a well-balanced structure with capital issue divisions according to function.

Following are the names of the 64 subsidiary companies existing before the company undertook simplification. In the third column are names of existing companies which will be headed by Penn-Ohio Edison. Companies 1 and 2 will disappear under present plans. The second half of the chart represents the situation at a recent date.

1 Republic Railway & Light Company.
2 Penn-Ohio Edison Company.
3 Zellenople Light & Power Company.
4 Pennsylvania-Ohio Electric Company.
5 Salem Lighting Company.
6 Pittsburgh District Electric Company.
7 Ohio River Edison Company.
8 Pennsylvania-Ohio Power & Light Company.
9 East Ohio Power & Light Company.
10 East End Traction Company.
11 West End Traction Company.
12-16 Five township lighting companies (Pa.).
17-38 Twenty-two township lighting companies (Pa.).
39 Beaver-North Sewickley Power Company.
40 Beaver-Franklin Power Company.
41 Lawrence-Wayne Power Company.
42 New Castle & Lowell Realty Company.
43 Youngstown Municipal Railway Company.
44 Pennsylvania & Mahoning Valley Railway Company.
45 Pennsylvania-Ohio Coach Lines.
46 Akron-Youngstown Bus Company.
47 New Castle & Mahoningtown Street Railway Company.
48 New Castle Electric Street Railway
49 New Castle & Lowell Railway Company.
50 New Castle Electric Company.
51 New Castle Traction Company.
52 Mercer County Light, Heat & Power Company.
53 Kinsman Electric Company.
54 Boston Mining Company.
55 Ohio River Transmission Company.
56 Shenango Valley Electric Light Company.
57 Sharon Gas & Water Company.
58 Mahoning County Light Company.
59 Shenango Valley Traction Company.
60 Pennsylvania Power Company.
61 Sharon & New Castle Street Railway
62 Sharon & New Castle Railway Company.
63 North East Coal Company.
64 Idora Park Company.

1 Penn-Ohio Securities Corporation.
2 Republic Railway & Light Company.
3 Penn-Ohio Edison Company.
4 Ohio River Edison Company.
5 Penn-Ohio Electric Company.
6 Pennsylvania Power Company.
7 Pennsylvania-Ohio Power & Light Co.
8 New Castle & Lowell Realty Company.
9 Ohio River Transmission Company.
10 East End Traction Company.
11 West End Traction Company.
12 Youngstown Municipal Railway.
13 Pennsylvania & Mahoning Valley Railway Company.
14 New Castle & Lowell Railway Company.
15 New Castle Electric Street Railway.
16 Pennsylvania-Ohio Coach Lines.
17 Akron-Youngstown Bus Company.
18 Cleveland & Mahoning Valley Coach Co.
19 H. A. K. Bus Company.
20 Pennsylvania-Ohio Tourist Company.
21 Youngstown Gas Company.
22 Elwood City Hydro-Electric Company.
23 Boston Mining Company.
24 Shenango Valley Traction Company.
25 North East Coal Company.
26 Mahoning County Light Company.

Old Plan

	Common	Preferred	Bonds
Arkansas Lt. & Pwr. Co. —	38,000 sh.	40,947 sh.	$60,000 Russellville W. & L. 1st 6s 3,799,300 Arkansas L. & P. 1st 6s 3,321,100 Arkansas L. & P. 1st and ref. 6s
Arkansas Central P. Co. —	150,000 sh.	11,789 sh. $7 cum. pf.	$992,000 Little Rock R. & E. 1st 5s 1,018,500 Little Rock R. & E. ref. 6s 3,500,000 Ark. Central P. 1st lien and ref. 6s
Pine Bluff Company —	$1,000,000	$1,000,000 7% cum. pf.	$678,000 Pine Bluff Co. 1st 5s 1,121,000 Pine Bluff Co. 1st 6s
East Arkansas P. & L. Co. —			No issues in hands of public
Smaller companies —			No issues in hands of public

New Plan

Arkansas Power & Lt. Co. —	Common Issue	$7 pref. issue	1st and ref. mortgage bonds Little Rock R. & E. 1st 5s Little Rock ref. 6s

ARKANSAS POWER & LIGHT SIMPLIFICATION

By means of refinancing, the Arkansas Power & Light Company was able to merge several operating units physically and financially. Several issues of operating units were replaced with issues bearing lower interest rates and a simpler and better balanced structure was made.

capital structures that were in existence. Money was plentiful, rates were low and utility credit in the money market had the highest standing, so that all conditions were conducive to the successful accomplishment of this task. Many executives in the industry took advantage of this favorable situation to recondition and remodel utility financial structures. The general principle followed was to issue new and modern securities and retire old and obsolete securities and in so doing to lower capital charges and to balance the capital issues to get a sounder structure. Complementary accomplishments were a simplification of the capital structures, a regrouping of operating units in a more orderly fashion and a separation of utilities into self-contained light and power, gas, steam heating, electric railway and oil properties whereby each became a corporate entity.

Some examples will indicate the methods followed and will show what is actually being done by the financial executive and his investment banker in the reconstruction of financial set-ups.

Case I.—In the case of Commonwealth Power Corporation, financial reconstruction was undertaken three or four years ago and has had remarkably successful results on the operation of the company and its subsidiaries. The intercorporate relationships of the Commonwealth Power Corporation and its subsidiaries, along with the various security issues throughout the structure, were such that money was costing too much. The general credit position was not as high as was desirable. The company was hampered in its development.

The first move in reconditioning the Commonwealth structure was to dissociate most of the railways, placing them in a separate corporation. This made no difference with reference to the parent company earnings — it was merely a corporate shifting. It was in the electrical properties that necessity for growth lay, and this corporate change freed them from the previous negative effect on the securities occasioned by their close relationship with the railways. In each of the subsidiary companies a modern mortgage with an open-end feature was created, and the bonds that had been issued under the old closed mortgage were called and retired. Customer-ownership campaigns were instituted to provide not only the excellent public relations that result from customer ownership but also that equity in preferred stock owned in the community, which has so great an influence on strengthening the position of the bonds of the company. As a result of these two moves, there were created sufficient working capital and a sufficiently strong cash position to free the subsidiary company from having constantly to borrow from the parent concern, thus in turn weakening its financial position. Both subsidiaries and parent company had larger amounts of cash on hand, and this improved their credit position. The specifications of the various new bond issues were such that they lent themselves to expansion. They allow the company at all times to take advantage of the market to obtain money on most advantageous terms.

Differs from Engineering Reconstruction

Case II.—One important difference exists between the reconstruction of the financial set-up and that of an engineering structure. Practically always the reconstruction of the financial set-up can be carried out without ultimate cost and usually with appreciable saving in the annual fixed charges. In replacing a power station, on the other hand, the engineer must practically scrap the old station and then create a new one. This involves the loss of that amount of money which was tied up in the old station. Of course, the modern accountant has written off this obsolete power station, but from the standpoint of the theory of conservation of matter there was a physical value in existence which no longer exists.

Bonds to Be Redeemed

	Bonds	Amount	Call Price
Central Indiana Lighting Company —	1st 5s, due 5/1/27	$288,500	102
Indiana Public Service Company —	1st 5s, due 1/1/31	100,000	105
Shelby County Water, Gas & Electric Company —	1st 5s, due 3/1/30	201,800	102½
United Gas & Electric Company —	Con. 5s, due 7/1/42	46,000	105
Jeffersonville Water Light & Power Company —	1st 5s, due 2/1/30	92,500	105
Franklin Water, Light & Power Company —	1st 5s, due 4/1/29	117,500	100
Warsaw Gas Company —	1st 5s, due 4/1/43	18,000	102
Goshen Gas Company —	1st 6s, due 6/1/27	60,000	100
Goshen Gas Company —	1st 5s, due 12/1/42	11,000	102
Indianapolis & Louisville Traction Company —	1st 5s, due 4/1/42	817,600	105
Indiana Power Company —	1st 6s, due 11/1/44	454,500	105
Indiana Power Company —	1st l. & g. "B", 6½s, due 11/1/41	1,175,000	105
Indiana Power Company —	Three-year 5½s, due 2/1/28	1,000,000	100½
Indiana Power Company —	S.f. 7½s, due 11/1/41	16,300	.....
Indiana Power & Water Company —	1st 6s, due 9/1/36	1,834,300	103
Orange County Public Service Company —	1st 6s, due 4/1/36	50,000	.....
Interstate Car Trust Equipment Company —	Notes, 6 & 7s, due serially	597,500	102

Bonds to Be Outstanding

	First mortgage and refunding 5s	.....	$24,052,100
	Underlying Divisional Bonds:		
United Gas & Electric Company —	1st 5s, due 7/1/42	$489,000	.....
People's Gas, Electric & Heat Company —	1st 5s, due 8/1/27	82,000	.....
New Albany Street Railroad Company —	1st 5s, due 8/1/27	192,000	.....
Indiana Power Company —	1st lien & gen. mtg. 7½s, due 11/1/41	1,248,500	2,010,500
			$26,062,600

SIMPLIFICATION OF INTERSTATE PUBLIC SERVICE

Revamping the capital structure of the five, made an annual interest saving of Interstate Public Service Company reduced $55,000 and produced a well-balanced and the number of issues from seventeen to simple structure.

The reconstruction of the Pennsylvania-Ohio Power & Light Company will illustrate the point under discussion. In June, 1924, that company found itself with the following issues of bonds:

		Due	Call Price
$12,734,500	First and refunding 7½s	1940	110
2,755,400	8 per cent notes	1930	107
2,000,000	6 per cent notes	1926	101½

On these bonds the annual interest charges were $1,295,520. In that month the company issued:

		Due	Sold at
$19,000,000	First and refunding 5½s	1954	98
2,700,000	6 per cent debentures	1939	97½
$21,700,000			

The annual charges on this total amounted to $1,207,000. With the necessary selling expense and discount subtracted from their face value, the proceeds of the issue were approximately $20,200,000. The old bonds were retired at a total cost of $18,900,000. As a result of this refinancing the company obtained consolidation of its debt from a group of bond and two note issues to one bond and one debenture issue, and a modern financial structure with modern mortgage and debenture provisions.

The old first mortgage had a limited authorization, and it was required that all of the bonds issued under that mortgage would have to become due in 1940, whereas under the new mortgage there is an open-end provision and the various series of bonds issued under that mortgage may be given such maturities as may seem most desirable at the time of issue. It also obtained longer average maturity; that is, it postponed the date at which it will be necessary to refinance. It further obtained something more than $1,250,000 of working capital and reduced the annual charges by almost $90,000.

Case III.—The Oklahoma Gas & Electric Company provides another example. In March, 1925, it had bonds outstanding to the extent of $28,395,700, divided as follows:

		Due	Call Price
$2,788,000	First 5s	1929	102½
6,750,000	First and refunding 7½s	1941	107½
7,000,000	First and refunding 6s	1941	105
1,948,500	8 per cent notes	1931	105
2,100,000	7 per cent mortgage notes	1926	101
2,000,000	6 per cent two-year notes	1926	101
270,500	5s (Shawnee Company)"	1926	101 and 105
1,788,700	6s and 7s	1942	106
3,750,000	6s	1952	....

In March, the company issued:

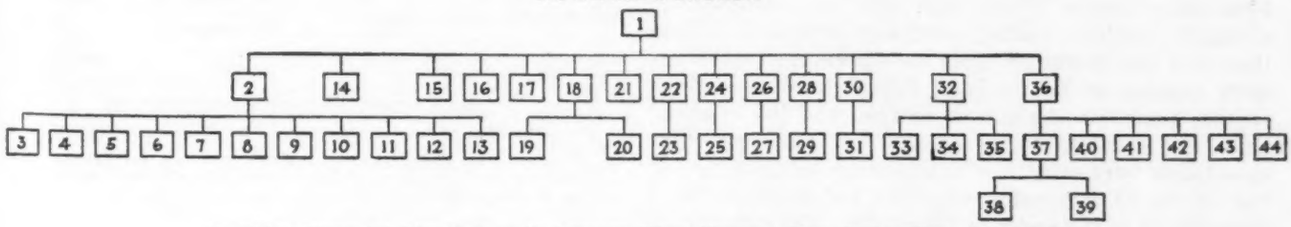
		Due	Sold at
$23,500,000	First mortgage 5s	1950	95
8,000,000	6 per cent debentures	1940	98½
31,500,000			

REFINANCING OF OKLAHOMA GAS & ELECTRIC

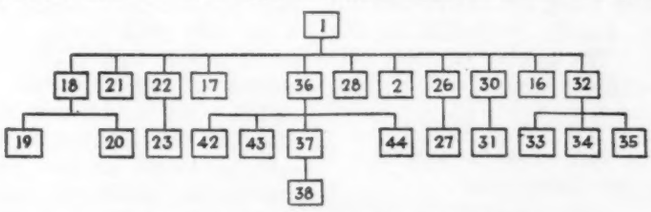
The Oklahoma Gas & Electric Company reduced nine issues to two. It simplified the capital structure and made an annual interest saving of about $200,000.

The proceeds from the sale of these bonds, calculated at the spread that was probably in effect at that time, amounted to about $28,600,000. The cost of retiring the old issues at their call prices was $29,700,000. In

Old Financial Structure



Simplified Financial Structure as It Appears When Mergers, Now Under Way, Are Completed



GENERAL GAS & ELECTRIC REFINANCING

The number of companies in the General Gas & Electric group was reduced from 44 to 25. Many old issues were replaced with new ones of modern type.

Substantial interest saving resulted from the remodeled capital structure and a balanced and well-proportioned group of securities was secured.

NAMES OF THE COMPANIES REFERRED TO BY NUMBERS IN THE ABOVE CHARTS

1. General Gas & Electric Corporation.
2. The General Finance Corporation.
3. Ortanna Electric Light & Power Company.
4. The Boyertown Electric Company.
5. Annville & Palmyra Electric Light Company.
6. Bernville Light, Heat & Power Company.
7. Berks-Lehigh Electric Company.
8. Birdsboro Electric Company.
9. Saylorsburg Light & Power Company.
10. Hamburg Gas & Electric Company.
11. Topton Electric Light & Power Company.
12. Weisenberg Township Electric Light & Power Company.
13. The French Creek Electric Company.
14. Newton Gas Company.
15. New Jersey Power Corporation.
16. Binghamton Light, Heat & Power Co.
17. The Jersey Corporation.
18. North Carolina Public Service Co.
19. The Salisbury & Spencer Railway Co.
20. Greensboro Bus Company, Incorporated.
21. Florida Public Service Company.
22. The South Carolina Gas & Electric Company.
23. Spartanburg Bus Company.
24. Manufacturers' Power Company.
25. Blue Ridge Power Company.
26. Broad River Power Company.
27. Columbia Railway, Gas & Electric Company.
28. New Jersey Power & Light Company.
29. Washington Gas Company.
30. Northern Pennsylvania Power Co.
31. The Waverly Electric Light & Power Company.
32. Reading Transit Company.
33. Reading Transit Bus Company.
34. Oley Valley Railway Company.
35. Leased Companies:
    - Northeastern Street Railway Company of Reading.
    - The Reading & Southwestern Street Railway Company.
    - Adamstown & Mohnsville Electric Railway Company.
    - Reading Traction Company:
      - The Reading & Temple Electric Railway Company.
      - The Reading City Passenger Railway Company.
    - East Reading Electric Railway.
    - Lebanon Valley Street Railway.
    - Schuylkill Valley Traction Company.
    - Citizens' Passenger Railway Company.
    - Norristown Passenger Railway.
    - Montgomery County Passenger Railway Company.
    - Conshohocken Railway Company.
    - Collegeville Electric Street Railway Company.
    - Roxborough, Chestnut Hill & Norristown Railway Company.
    - The Trappe & Limerick Electric Street Railway Company.
    - Wissahickon Electric Passenger Railway Company.
36. Metropolitan Edison Company.
37. Pennsylvania Edison Company.
38. Easton Gas Works.
39. Interurban Gas Company.
40. Metropolitan Power Company.
41. York Haven Water & Power Company.
42. Hanover & McSherrystown Street Railway Company.
43. The Maryland Public Service Company.
44. Leased Companies:
    - Neversink Light, Heat & Power Company.
    - Reading Electric Light & Power Company.

this case about $1,000,000 probably had to be secured through the issue of preferred stock, but there was at this same time some merging of the properties concerned, so that this refinancing was more than merely trading dollars for dollars and the issue of some stock was, therefore, not inconsistent. The benefits were: A very evident consolidation of debt and simplification of structure; reduction of annual charges by about $200,000; the elimination of early maturities; the substitution of modern issues in place of several of the old type.

Simplification Often the Main Reason

Case IV.—Another outstanding example of the benefits of refinancing to simplify the capital structure is seen in the experience of the General Gas & Electric group. Until recently there were 44 companies in the organization. Refinancing and simplification reduce this number on completion to about 25 companies. The subsidiaries the common stocks of which are now owned directly by the corporation have a property value of more than 85 per cent of the total, and the subsidiaries the common stocks of which are owned indirectly have a property value of less than 15 per cent of the total. In addition to the simplification of the parent capital structure, those of several of the subsidiaries have been materially simplified.

Case V.—The refinancing and simplification process sometimes requires an almost complete regrouping of the individual units. This was true in the case of the Penn-Ohio Edison. Two years ago this company had a highly involved holding company structure. Since that time the operating units have been grouped in orderly fashion on the basis of function. Many of the smaller companies have been merged and the relationships are now all clearly defined. In this particular case there were very few outstanding security issues. Out of the 64 companies only nine had bonds or stock outstanding in the hands of the public. The refinancing and regrouping of the system place the companies under four main subsidiaries, directly controlled by the Penn-Ohio Edison Company. The number of companies has been reduced from about 65 to approximately 25 at the present time.

Electric Bond & Share Company Simplifies Newly Purchased Companies

Case VI.—It has usually been the policy of management and engineering companies to keep the capital structure of affiliated companies as simple as possible. The Electric Bond & Share Company, for example, recently merged a group of Arkansas utilities under the Arkansas Power & Light Company, the merger being physical as well as financial. Nearly all of the communities to be served by the new company are interconnected or will be interconnected in the near future by a transmission system about 1,300 miles in length. Existing issues were retired in favor of a new parent company bond issue and well-proportioned amounts of preferred and common stock. In addition to the consolidation of obligations of the constituent companies, the merger provides that the existing $7 or 7 per cent preferred stock of the respective companies is to be exchanged share for share for the $7 preferred stock of the new company. Thus the company begins its existence with a capitalization consisting of only two underlying issues of bonds, an issue of preferred and an issue of common stock. This simple arrangement replaces the complex group of securities issued under the auspices of the various constituent units. The change effected through the refinancing is illustrated on page 1194.

Case VII.—Another instance of a simplification project amply justified by the economies resulting is that of the Florida Power & Light Company. The first step taken was to redeem all the outstanding mortgages of the absorbed companies. Stock issues also were retired with the exception of the then outstanding preferred stock of the Southern Utilities Company, and provision was made for the exchange of this stock for the new preferred stock of the new company. In this way the Florida Power & Light Company was placed in a position to obtain new funds on straight first-mortgage bonds. Six bond issues bearing 5, 6 and 7 per cent coupon rates and totaling more than $5,000,000 were redeemed. Immediately following its organization the company issued $30,000,000 of first-mortgage 5 per cent gold bonds, 100,000 shares of $7 preferred stock, 50,000 shares of second preferred and 2,500,000 shares of common stock, all without par value. In addition to a substantial saving in annual interest charges, the earning capacity of the group was increased, better service was given to the communities and ample provision was made for future financial needs to meet expansion requirements and service demands.

		Bonds of the Old Companies	
Daytona Public Service Company	—	1st mortgage 7s.....	$624,500
Lakeland Gas Company	—	1st mortgage 5s.....	200,000
Southern Utilities Company	—	1st mortgage 6s.....	3,569,000
Oliver Ice Company	—	1st mortgage 6s.....	214,000
St. Johns Electric Company	—	1st mortgage 5s.....	190,000
Miami Gas Company.....	—	1st mortgage 5s.....	326,600
			$5,124,100

		New Mortgage Bond Issues	
Florida Power & Light Company..	—	1st mortgage 5s.....	$30,000,000
		1st mortgage 5s.....	12,000,000
			$42,000,000

FLORIDA POWER & LIGHT SIMPLIFICATION

Simplification of capital set-up of the Florida Power & Light Company reduced the number of issues from six to two and saved in interest more than $50,000 yearly. Modern mortgages were substituted for old forms and a well-balanced and marketable group of securities resulted.

In addition to the examples that have been cited, the process of refinancing and simplification has been going on continuously in the case of many of the large groups. Companies like the Associated Gas & Electric, the Public Service Corporation of New Jersey, and numerous others have carried out very extensive refinancing programs that have resulted in considerable readjustment of company relationships. Many other illustrations might be cited of the advantages, in fact, of the necessity, of keeping a financial structure thoroughly adequate to meet modern conditions. Just as the engineering of plants erected in 1900 was excellent as measured by the engineering standards at that time, so was the financing of these companies done in what was a modern way at the time it was carried out. But just as an obsolete generating station is replaced by a product of modern engineering, so does it frequently happen that a financial structure can to advantage be replaced by one built to meet modern conditions.

Start Substation Standardization

Basic Principles Needed and Agreement on Clearances—Switching Arrangements Too Much Subject to Opinion—Structure Standardization a Small Part of the Program

By M. M. Samuels
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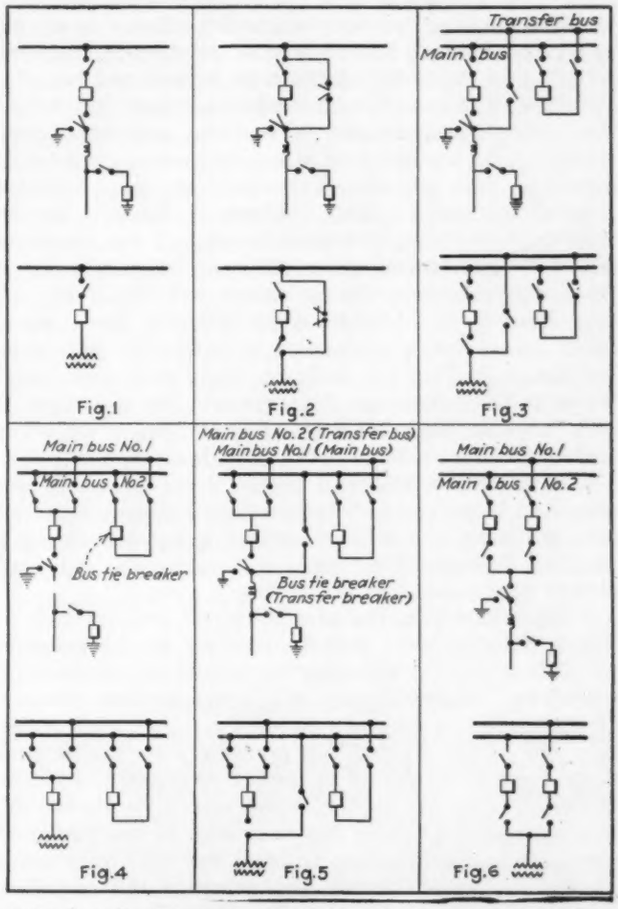
THE difficulties involved in the standardization of outdoor substations are manifold and are well known, having been discussed time and again. The greatest difficulty probably lies in the fact that the outdoor substation offers a better field for the competent designer to give free vent to his imagination and to produce beautiful designs than any other field of electrical engineering, due to the non-existence of restricting building conditions. This same lack of limitation, however, makes it possible for the incompetent designer to throw equipment together in the most awkward manner, as long as the proper interconnections are made, thus producing a complicated monstrosity that is called an outdoor substation. This feature of the problem cannot be tackled systematically and must be left out of consideration in the attempt to standardize outdoor substations. Once this is done, it will at once become obvious that the case is not hopeless if approached from the proper angle and with proper seriousness of mind. Instead of proclaiming that standard substations exist where hardly a trace of standardization can be detected in reality, the attempt should be made to establish some standard fundamentals underlying the design of all substations, and then the standardization of the outdoor substation itself will be a comparatively simple matter.

Standardization in Insulators Helps

The standardization of insulators by manufacturers of outdoor equipment in recent years has been a great help to station designers. Even though the national societies such as the N.E.L.A., the N.E.M.A. and the A.I.E.E. have not as yet adopted any definite insulator standards, the great majority of the more reputable manufacturers are now furnishing equipment with practically interchangeable insulators. However, a great deal of work is as yet to be done toward standardization of distances between conductors and phase spacings of disconnecting switches before any standardization of outdoor substations can be seriously undertaken. A recent canvass among manufacturers and operators brought out the surprising fact that even the most prominent manufacturers and operators have no accepted standards of their own, and the great variance in their recommendations may be seen at a glance in Figs. 7 and 8. The N.E.M.A. appointed a special committee to investigate this question and to make recommendations toward standardization, but no agreement has been reached.

In many cases the distance between phases will determine the size and cost of the station structure, and the lack of any standards along this line leaves the field open to unscrupulous competition and really prevents



FIGS. 1 TO 6—POSSIBLE SWITCHING ARRANGEMENTS TO SERVE AS A BASIS FOR STANDARDIZATION

the establishment of any standard designs for substations. It is hoped that the N.E.M.A. committee will at least establish the beginning of a solution of the problem in the form of some standard, even if it be only in a preliminary form, to be modified later by experience. It is apparent from Fig. 7 that two of the most prominent manufacturers identified as "A" and "B" are in perfect agreement in regard to spacing of conductors, and it should not be too difficult for the others to get together on some standards. It would also appear from Fig. 8 that the differences in regard to spacing of horn gap switches are not very great and should not be unsurmountable. Possibly it would be easier to establish two sets of standards, say for heavy duty and light duty, or for cold climate and warm climate.

By far the greatest obstacle is the lack of any accepted connection schemes. Every system has its own

operating conditions to contend with and the pet schemes of its own engineers, resulting in an unlimited number of connection schemes, some simple, some of necessity complicated and others complicated for no reason at all. As a rule the smaller systems have the most complicated connection schemes, due no doubt to the fact that the larger systems have more skillful engineering at their disposal, confirming again the well-known fact that the simplest and shortest path is the most difficult to find.

Complicated Transfer Connections Often Defeat Own Purpose

Even some of the most important recent installations show complications in their connection system that seem to serve no good purpose whatever. There is an exaggerated fear of breakdowns of oil circuit breakers, resulting in many installations of bypass and transfer switching that are often so complicated that they defeat their own purpose, because the operator uses these transfer devices so seldom that when an emergency actually arises he does not even know that all these transfer possibilities are available. There is many a station with only one bank of transformers and one incoming line, but with two or three different transfer methods in each circuit, even though the probability of an outage caused by line trouble on the incoming line is many times greater than one caused by a breaker failure on one circuit and the line failures would take a good deal longer to be cleared up. Furthermore, recent designs of very large stations show transfer equipment on every circuit, but only one bus, even though an insulator failure on this bus would tend to shut down the whole system. An important substation should always have two sets of buses, a transfer bus not being considered a bus for this purpose, because it can serve only one circuit at a time.

When considering the advisability of transfer switching, a decision must first be reached on the question whether a certain customer or a certain territory is served by one circuit only or by two or more circuits. If there are two or more circuits going in each direction, one of the circuits can practically always be shut down for a short period to inspect or repair a breaker. If there is only one circuit, which cannot be shut down, the expense of transfer switches may be warranted in some cases, provided line troubles are very infrequent on the particular circuit and provided the complications introduced by the transfer equipment are in reality less expensive than two sets of switches. However, even when transfer switching is advisable, as, for instance, to facilitate periodic inspection of breakers, in outlying automatic or supervised stations, the equipment should be as simple as possible in order not to defeat its own purpose.

Diagrams Serve as a Basis for Substation Standardization

After carefully going over practically all the schemes of connections employed in the various more important systems now operating, it appears that the diagrams shown in Figs. 1 to 6 represent all possible cases of switching and should serve as a basis for substation standardization. If there is any necessary operation that cannot be accomplished by any of these diagrams, it is hoped that some one will bring it to the attention of the readers. Fig. 1 is a single-bus, single-switch scheme, the simplest imaginable, and Fig. 2 is the same scheme

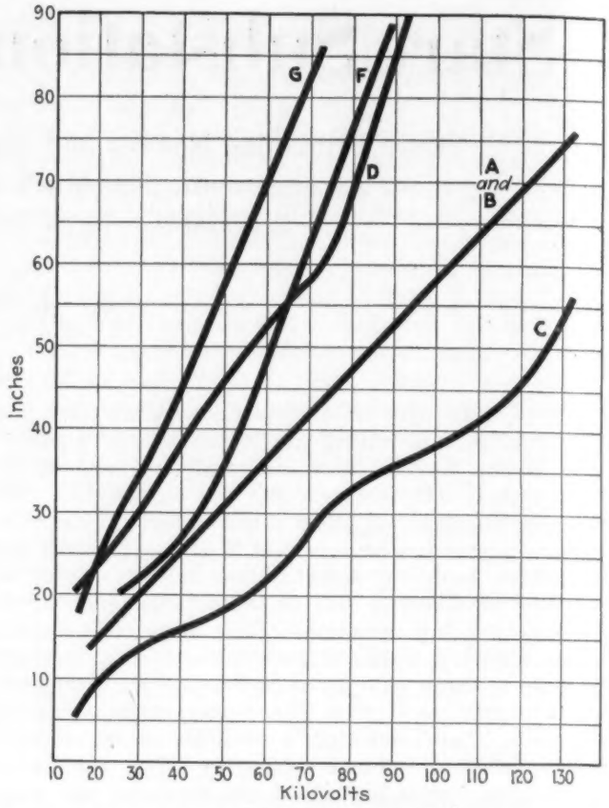


FIG. 7—SPACINGS BETWEEN RIGID CONDUCTORS FOR OUTDOOR SUBSTATIONS AS RECOMMENDED BY SEVERAL MANUFACTURERS AND OPERATING UTILITIES

with a horn gap transfer switch added, as may be needed in some outlying automatic or supervised station for periodic inspection. Fig. 3 is a single-bus scheme with a transfer bus and a transfer breaker, so that if any main breaker is out of service the particular circuit can be supplied from the main bus through the transfer breaker and the transfer bus. Even though this scheme has recently been adopted for a very prom-

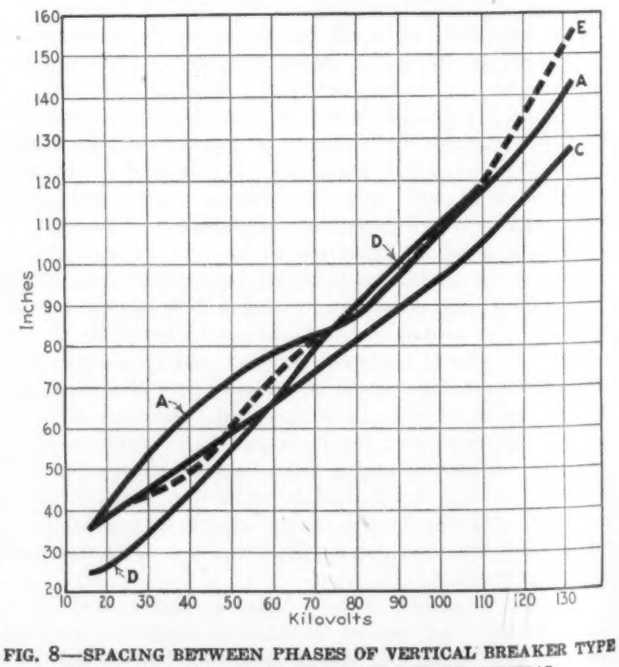


FIG. 8—SPACING BETWEEN PHASES OF VERTICAL BREAKER TYPE HORN GAP SWITCHES RECOMMENDED BY SEVERAL MANUFACTURERS

inent installation, it has the weakness of a station with one bus, since the transfer bus can serve one circuit only and is really not a bus but merely a transfer connection, and one insulator failure on the bus or on a disconnecting switch connected to the bus will shut down the whole station, or in case of bus sectionalizing will shut down that part of the system that is connected to that section of bus, which on a large system may mean the cutting off of an extensive territory. The scheme may have its usefulness, though the writer fails to see it.

Fig. 4 is now quite commonly used on many systems and represents probably the most useful basic scheme of connections. It has two main buses, one circuit breaker and two bus disconnects per circuit and one bus tie breaker for transferring or splitting load.

Fig. 5 shows how by adding one disconnecting switch per circuit to the scheme of Fig. 4 all necessary transfer means are provided without the installation of any transfer bus or transfer breaker. In this ingenious and simple scheme, which to the writer's best knowledge was first suggested by F. J. Douglas, if a transfer is required, one of the two buses becomes a main bus, the other a transfer bus, and the bus tie breaker becomes a transfer breaker. After the transferring has served its purpose, two main buses and a bus tie are again available. This is a much stronger and more flexible scheme than that shown in Fig. 3.

Fig. 6 shows two buses and two breakers per circuit, about the most elaborate imaginable and of course the very best operating scheme, but it should be used only when economic conditions require and justify it.

Bringing Standardization Within Reach

After these basic diagrams are accepted the following subdivisions will have to be made for each of the six schemes and for each voltage:

A. Stations with rigid buses.
B. Stations with suspension buses.
C. Stations with vertically mounted disconnects.
D. Stations with horizontally mounted disconnects.

There would, therefore, be required a maximum of 24 standards for each voltage, and since a separate design is generally needed for a line and a transformer circuit, there would be a maximum of 48 standards. If "A" or "B" and "C" or "D" are eliminated, there would be a maximum of only 24 standards per voltage, and it would no doubt be possible to arrange the same bay for a line or a transformer so that there would be required a total maximum of only twelve designs for each value of voltage.

It should likewise be possible to eliminate at least two of the six basic diagrams, reducing the total number of designs to eight for each voltage. By a little scheming it is also possible to arrange not more than two sets of steelwork for these eight possibilities, thus bringing standardization within practical reach. The contour and shape of the available property, the direction of outgoing lines, the arrangement of the railroad siding, etc., must of course be left out of consideration in any standardization, and there will always be the same advantage in a specially designed substation over a standard substation as there is in a specially designed house over one built for real estate speculation, but there is no denying that an enormous amount of labor, time and money will be saved if standardization is carried out along the lines which have been suggested and outlined here.

Letters from Our Readers

"Amusing Salesmen" and High-Quality Products

To the Editor of the ELECTRICAL WORLD:

J. F. Lincoln of the Lincoln Electric Company, in a letter published in your issue of April 23, draws the conclusion that an "amusing salesman" rather than his product or its price determines the sale. This is a radical conclusion if it is to be supposed that it applies to the electrical engineering profession as purchasers of equipment. Such a conclusion, if well founded, would mean but one thing, that the standard of engineering ethics is at a low ebb.

However justified Mr. Lincoln's criticism may be in some instances, I am sure it is not applicable to electrical engineers in general. Only yesterday a very successful and "amusing" salesman of pleasing personality complained to me that neither his presence "on the job" nor his frequent visits to us seemed to influence in any way his success or failure in securing our business. This situation is characteristic of the better engineering organizations. It goes without saying that we all prefer to deal with the salesman who has a pleasing personality and that we enjoy a funny story occasionally, also that we shun the man who lacks in personality or tries to "browbeat." However, if the latter type of salesman has a product of high quality at the right price and his company's policies enable him to present his product favorably, that product should have preference.

I am forced to conclude from Mr. Lincoln's letter that his salesmen, as is largely to be expected from his company's product, have to deal chiefly with non-engineering purchasing organizations. Sales experience under these conditions cannot be justly imputed to apply to the engineering profession in general.

WELLEN H. COLBURN,
Electrical Engineer.

Boston, Mass.

Wired Homes of the World

To the Editor of the ELECTRICAL WORLD:

I have read with great interest an article in the Feb. 19 issue of the ELECTRICAL WORLD under the above title. As it may be of interest to you to know how conditions are in Norway in this respect, I may mention that it is figured that more than 75 per cent of all homes are wired. This is a very high figure considering the size of the country and the scattered population, there being only about 2,800,000 inhabitants on 324,000 square kilometers, which corresponds to about 8,500 per square kilometer. In Oslo, with a population of about 255,560, 99.9 per cent of the homes are wired, the remaining 0.1 per cent consisting of a few old buildings which are to be demolished. The maximum load in Oslo in 1926 was 71,500 kw., which corresponds to about 280 watts per capita. In the same year there was delivered about 350,000,000 kw.-hr., or about 1,400 kw.-hr. per inhabitant.

The lamp consumption in Norway is about 1.4 per capita per year, but the lamps used in this country have an average life of about 2,000 hours, while the life of lamps used in United States of America, as far as we know, is considerably shorter. The consumption of lamps in Norway would be a good deal more than three per capita were their lifetime the same as in the United States.

H. HORN,
Director-General.

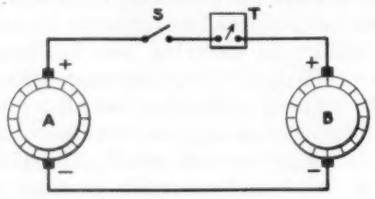
Oslo Gass- og Elektrisitetsverker,
Oslo, Norway.

Central Station and Industrial Practice

Magneto Tachometer Adapted as a Slip-Meter

By John E. Lear
Professor of Electrical Engineering,
University of North Carolina,
Chapel Hill, N. C.

THE sectored-disk method of measuring induction-motor slip, so often used on account of its simplicity and cheapness, is very inaccurate even at light loads, and becomes out of the question if the slip amounts to more than 10 per cent.



TACHOMETERS CONNECTED FOR MEASURING "SLIP"

Magneto *A* is run by a small four-pole synchronous motor; *B* is run from the induction motor. A switch *S* and the indicating instrument *T* are connected as shown to give readings directly in revolutions per minute

A positive slip-meter which reads the slip directly in revolutions per minute and is extremely accurate is available, but it has the disadvantage of high first cost.

After using magneto-type tachometers a short time it occurred to the writer that here was a means of measuring slip directly in revolutions per minute to the same degree of accuracy that the tachometers would indicate speed.

If two of the magnetos are run at the same speed and connected so that their voltages are in opposition, the resultant voltage is at zero. If one magneto runs faster than the other, the resultant voltage will be the difference between the two potentials, which, in turn, is proportional to the difference in speed between the two magnetos. All that is necessary, therefore, in order to measure the slip of an induction motor is to have one tachometer running at synchronous speed and the other at the speed of the motor under test. The two magnetos are connected in opposition with an indicating voltmeter in the line between them. The voltmeter, calibrated in revolutions per minute, shows the slip directly in revolutions per minute.

The regular instruments used in the laboratory are calibrated for 2,000 r.p.m. In order to take care of the slip measurements it was decided that a scale maximum of 500 r.p.m. would be sufficient for the purpose. Therefore a special scale reading only to this value was put on one of the voltmeters. The extra cost for this scale, and the cost of the synchronous motor—less than $25 in all—represents the material cost of this slip-meter, since the magneto tachometers were already a part of the laboratory equipment. Both magnetos are direct connected to their drive shafts through telescoping couplings, hence there cannot be any slip between shaft and magneto. The combination described here has been in use for several months and the experiments performed indicate that a slip of 2 r.p.m. can be read with an accuracy of one-half of 1 per cent.

While it is true that it would be necessary to have a different synchronous motor for testing induction motors having different numbers of poles, four-pole motors are quite common, hence a single four-pole synchronous motor will take care of most testing requirements.

Suggestions for Handling Poles

YEARS of experience have shown that unless a well-defined method is used to unload cars, unnecessary work, injury to men and perhaps broken poles will result. The Page & Hill Company, Minneapolis, Minn., offers the following suggestions from the procedure that has proved most convenient and successful in its yards.

Carloads of poles frequently travel long distances, and occasionally, from rough handling in transit, stakes and wires are either broken or weakened to such an extent that some hazard exists in unloading unless all the steps outlined here are carefully followed out. To avoid this unnecessary hazard, the following precautions are suggested:

1. Before starting to unload, every stake should be carefully inspected to be sure that none is broken or that none of them has sheered off at the stake pocket.

2. Stake pockets should be examined on cars to be sure that they are tight and that the bolts are neither broken nor loosened.

3. As close an examination as possible should be made of each of the wirings to determine whether or not the binding wires have been broken while the car was in transit.

If broken stakes are found on the side opposite from the side to be unloaded, the stake or stakes should be carefully braced, preferably with timber of sufficient length and strength that it can be braced about midway of the length of the stake and at an angle of approximately

SKIDS IN PLACE PREPARATORY TO UNLOADING POLES IN APPROVED FASHION

POLES DROP INTO A CABLE SLING FIRST AND THEN DOWN SKIDS TO GROUND

45 deg. to the ground when possible.

If car pockets are loosened or broken, the same precaution should be taken, and in any instance where several car pockets have been broken or loosened, the car body on the opposite side to that unloaded should be shored up with short pieces of timber and then the stakes braced as suggested above. No one should be permitted to climb on top of a load of poles regardless of whether the car and its bindings are in good condition or otherwise.

Short wooden skids should be placed against the side of the car on which it is intended to proceed with the unloading. Metal skids should never be used, according to this outline. Rope or cables should be fastened to the fore side of the car (side to be unloaded), fastening to trucks or truss rods. The cable should then be passed over the load to the opposite side of the car, wrapped once or twice around arch bars or truss rods, then carried around the end of the car with about two turns over the drawbars. Ropes or cables should not be fastened on the back side of the car so securely that they cannot be played off. Next the center stake and the wires on the fore side of the load should be cut, leaving the two end stakes and wire intact until the last. The middle wires on the two end stakes should then be cut. With workmen holding the ends of the cables at each end of the car, being sure that at least two wraps have been taken around the drawbars, the two end stakes on the fore side of the car may be cut. After these end stakes are cut the load will drop into the sling and can readily be eased to the skids. After the poles reach the skids, the cables can be loosened and the poles rolled away.

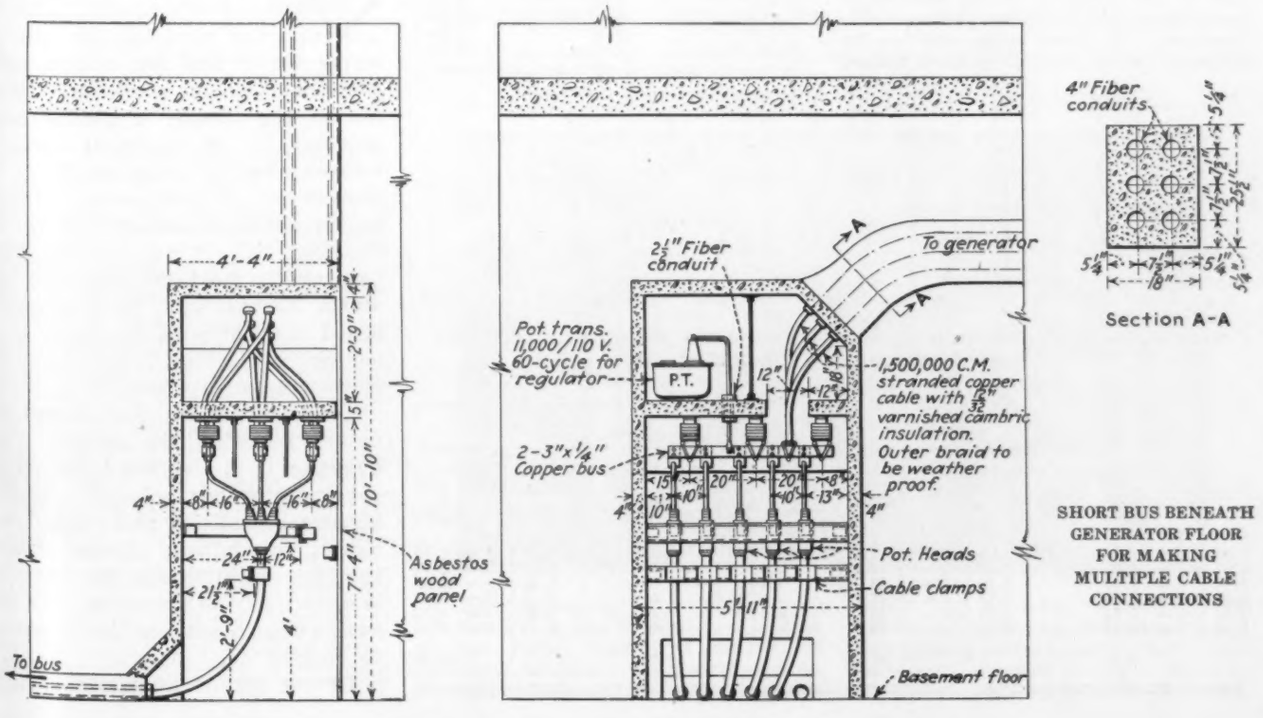
With a steel cable or rope there is practically no chance for the poles to drop and become injured or broken. At the same time the personal hazard to the men concerned in the unloading operation is reduced to a minimum.

Generator Bus for Multiple-Cable Connections

BY I. C. ROBERTS
Assistant Engineer Portland Electric Power Company, Portland, Ore.

AS THE CAPACITY of generator installations increases the problem of generator cable connections becomes more important. The Portland Electric Power Company has adopted different sizes and classes of cables which it stocks, including 3x400,000-circ.mil cable for 11,000-volt service, which is the largest size used on transmission lines and generator leads. This size cable is not of sufficient capacity for the larger generators, and consequently more than one cable is required.

Where more than one cable is required, a convenient means of multiplying the cable is necessary. The accompanying drawings show the simple and compact, yet accessible, type of cable connection bus con-



SHORT BUS BENEATH GENERATOR FLOOR FOR MAKING MULTIPLE CABLE CONNECTIONS

struction that is used on a 20,000-kw. generator of this company. The potential transformer for the voltage regulator occupies accessible space directly over the bus and is inclosed by using ¼-in. asbestos wood panel. This scheme for connection to generator leads may be used on much larger machines by simply extending one end of the compartment in order to accommodate the necessary number of cables and is in accord with the company's general practice of uniformity in station design.

Basis for Determining Transformers and Secondaries

CONTAINED in the handbook on standard overhead construction that is issued to the subsidiaries of the United Light & Power Company is a method for arriving at transformer locations and sizes, and sizes of secondary conductors. This method is simple and local managers of small properties need only follow the directions on the sheets to make their distribution systems approach closely to modern ideals of economy.

Quoting from the handbook:

1. Lay out section to be fed, showing each pole and number of services to be fed from each.

2. Determine total load per pole from Table I, taking into account class of territory as well as range loads, etc.

3. Locate transformer at some assumed point as T_1 in the diagram shown herewith. Then, starting at T_1, add up the products of the number of spans times the loads per pole as in the example. If these totals are too far different, move the transformer toward the side producing the largest total kilowatt spans as T_2 and repeat the process. The point giving the nearest balance in the total kilowatt spans is the proper location for the transformer.

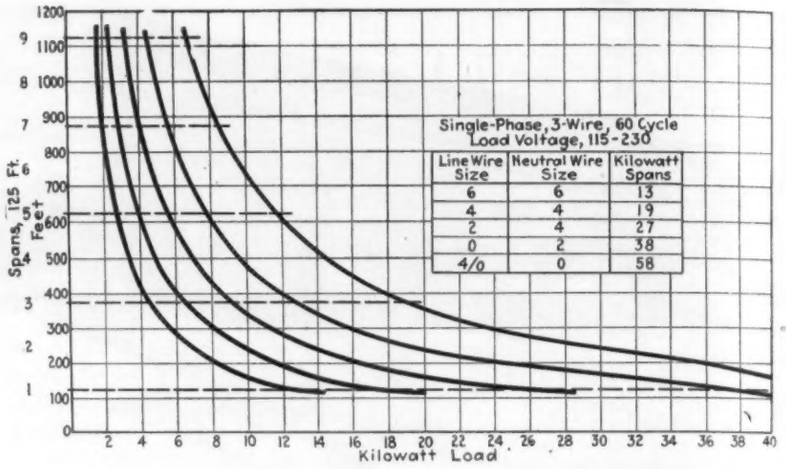
The correct wire size to give 3 per cent drop is taken from the three-wire, 115/230-volt curve and table. In the example, the larger of the two sums is 27.3 kilowatt spans. Therefore No. 2 wire should be used with a No. 4 neutral, since the table shows this size to be good for 27 kilowatt spans.

Branch lines should have their total load charged to the pole where they join the main feeder in determining feeder sizes. Branch line sizes should be figured starting from this pole by the same kilowatt span method as before.

The sum of the total loads per pole in the example is 13.7 kw., hence a 15-kw. transformer should be installed.

In applying the above method, vacant lots should be included, assuming an average-sized house to be built on each lot.

If transformer location T_2 falls on a buck-arm or street-light pole, place transformer on next pole and determine wire size from larger of the two sums of kilowatt spans calculated for this location.

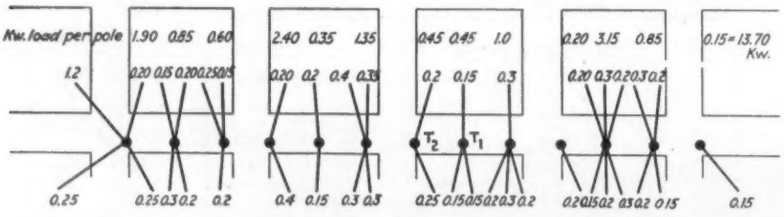

Single-Phase, 3-Wire, 60 Cycle
Load Voltage, 115-230
Line Wire Size | Neutral Wire Size | Kilowatt Spans
6 | 6 | 13
4 | 4 | 19
2 | 4 | 27
0 | 2 | 38
4/0 | 0 | 58
Spans, 125 Ft. Feet
Kilowatt Load

DISTANCE THAT VARIOUS LOADS CAN BE TRANSMITTED WITH 3 PER CENT IMPEDANCE DROP

(Load power factor 95 per cent, 8-in. wire spacing. Neutral wire on top spool.)

TABLE I—REQUIRED TRANSFORMER CAPACITY FOR RESIDENCES

Number of Rooms in Residence	Kilowatt Demand—Average Territory	Kilowatt Demand—High-Grade Territory
4 or less	0.15	....
5 to 6	0.20	0.25
7 to 8	0.25	0.30
9 to 10	0.30	0.40
11 to 12	0.40	0.50



METHOD FOR DETERMINING SECONDARY WIRE SIZES AND TRANSFORMER SIZE AND LOCATION FOR RESIDENTIAL LIGHTING LOADS

SAMPLE CALCULATION

Transformer at Pole (T_1) — To Left of Pole (T_1) Kw. Spans	Transformer at Pole (T_1) — To Right of Pole (T_1) Kw. Spans	Transformer at Pole (T_2) — To Left of Pole (T_2) Kw. Spans	Transformer at Pole (T_2) — To Right of Pole (T_2) Kw. Spans
0.45 × 1 = 0.45	.....	.....	.....
1.35 × 2 = 2.70	.....	1.35 × 1 = 1.35	0.45 × 1 = 0.45
0.35 × 3 = 1.05	1.00 × 1 = 1.00	0.35 × 2 = 0.70	1.00 × 2 = 2.00
2.40 × 4 = 9.60	0.20 × 2 = 0.40	2.40 × 3 = 7.20	0.20 × 3 = 0.60
0.60 × 5 = 3.00	3.15 × 3 = 9.45	0.60 × 4 = 2.40	3.15 × 4 = 12.60
0.85 × 6 = 5.10	0.85 × 4 = 3.40	0.85 × 5 = 4.25	0.85 × 5 = 4.25
1.90 × 7 = 13.30	0.15 × 5 = 0.75	1.90 × 6 = 11.40	0.15 × 6 = 0.90
35.20	15.00	27.30	20.80

Relay for Alarm Purposes Automatically Resets Self

BY R. L. DE LOACHE
Electrical Engineer

NEARLY every power station is equipped with various types of alarm devices that sound when some abnormal condition is reached. These alarms are usually a bell or horn actuated by an electrical contact-making device. Occasionally it is desired that the alarm sound as long as the abnormal condition persists; however, this is not generally the case, and in most instances after the alarm has sounded it is acknowledged and stopped by opening a switch in the electrical circuit. It is then necessary to wait until the abnormal condition has cleared up before reclosing the switch. The objection to this system is that after the operator has acknowledged the abnormal condition and stopped the alarm, the human element enters into the situation and the operator is very likely to forget to close the switch when conditions have returned to normal.

By the use of a simple auxiliary

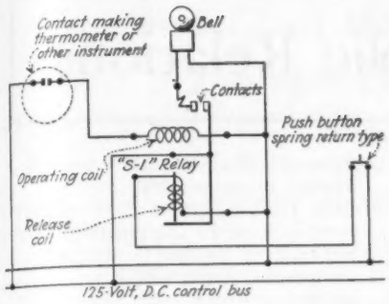


FIG. 1—SCHEMATIC WIRING OF RELAY ALARM SYSTEM

relay, it is possible for the operator to acknowledge and stop the alarm and at the same time leave it in condition to sound upon the occurrence of the next abnormal condition. Such an auxiliary relay is the type S-1, which was originally developed by the Westinghouse Electric & Manufacturing Company for use in connection with oil circuit breakers to give them trip-free characteristics. This relay, however, has other applications than that for which it was originally intended. Its use as an automatic reset device in an alarm circuit is an example.

Since the S-1 relay was designed for use as an oil circuit breaker control relay, its construction is of necessity much heavier than is required for bell-alarm work. The operating coil requires approximately 0.3 amp. at 125 volts, and care should be exercised to make sure that the contact-making device is capable of breaking the operating coil current without damage to itself.

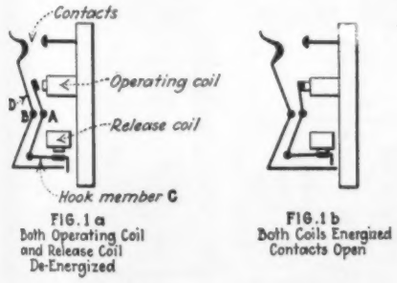


FIG. 1 a
Both Operating Coil and Release Coil De-Energized

FIG. 1 b
Both Coils Energized Contacts Open

FIG. 2—AUXILIARY RELAY APPLIED TO A SPECIFIC ALARM SYSTEM

The relay is equipped with a main operating coil and an auxiliary reset or release coil. There are two movable members; one, hinged at *A*, is the armature which is attracted by the operating coil; the other, hinged at *B*, is the contact member and is not acted upon by the magnetism of either coil. The operating coil is energized by the closing of the thermometer contacts and the armature acting through pivot *A* pulls the hook member *C* away from the panel. The hook engages the arm *D*, which rotates the contact member around pivot *B* to close the contacts. The relay contacts are now closed and the bell rings. In order to stop the bell, the operator presses the push button, which is of the spring return type. This energizes the release coil, which pulls the hook member up, releasing arm *D* and allowing the contact member to resume its original position. (See Fig. 1). The contacts have now opened, silencing the bell. The operator releases the push button and the release coil is de-energized; however, the contacts cannot close again until the operating coil has been de-energized to allow the armature to fall out and the hook member to re-engage with the end of member *D*. Since the operating coil is de-energized by the opening of the thermometer contacts, the relay is reset as soon as the temperature has dropped to normal.

Rural-Line Specifications—III

Of Wisconsin Power & Light Company

Poles

THE minimum size of pole to be used in constructing rural lines is 30-ft. Class D—Western Red Cedar or its equivalent in other species of poles that have been approved for use in the company's lines by the proper authorities. In general, main lines or other important three-phase feeders should be constructed of 30-ft. Class C poles, and when longer poles than these are required to obtain proper clearances, 35-ft. Class C and 40-ft. C, and above this Class B poles should be used. A pole stronger than Class C in lengths of 40 ft. and less is not required for any conditions referred to in these specifications as standard. If special conditions must be met due to the crossing of lakes, marshes, streams or deep valleys, the strength of the special construction shall not be less than that required for grade C in heavy loading districts when no other specific grade is required.

For single-phase lines 30-ft. Class D poles will generally be adequate, except at points where the line makes an angle of 15 deg. or more, where Class C poles should be used. The table on page 1017 of the ELECTRICAL WORLD for May 14, 1927) indicates the class of poles required for standard rural lines.

Poles erected for supporting transformers shall not be smaller than Class C and of such height as will provide proper clearance to services leaving transformers. All poles, regardless of class or length, must have a "B" butt treatment.

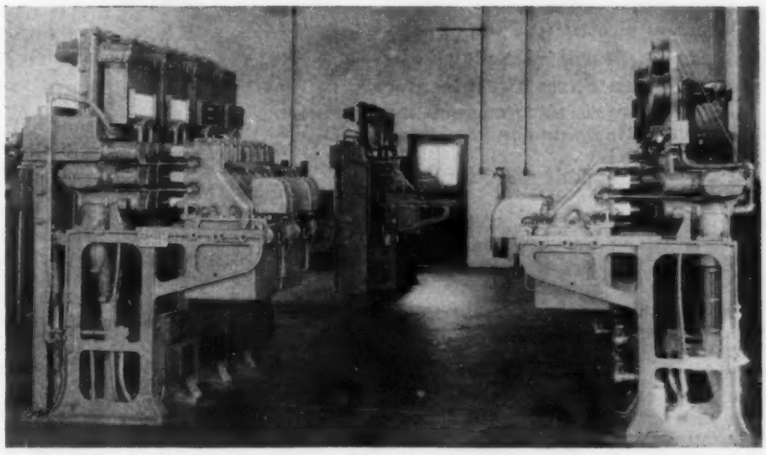
In order that poles may be readily identified, after erection they shall be branded by distributor about 12 to 15 ft. from the butt with letters indicating class and butt treatment and the name or trademark of the distributor and year purchased.

Poles are to be set in accordance to the depths indicated in the accompanying table, and raked at angles.

DEPTH TO SET POLES AND RAKE AT CORNERS

Length of Pole, Ft.	Set in Rock, Ft.	Set in Good Soil, Ft.	Set in Sand, Ft.	Rake at Corner, In.	Set at Corner or Dead End
25	3.5	4.5	5.0		Poles set at corners or heavy dead ends are to be set 6 in. deeper than given in this table for the soil conditions that apply.
30	3.5	5.0	5.5	15	
35	4.0	5.5	6.0	17	
40	4.0	6.0	6.5	20	
45	4.5	6.0	6.5	23	
50	4.5	6.5	7.0	26	
55	5.0	7.0	7.5	29	
60	5.0	7.5	8.0	32	
65	6.0	7.5	8.0	35	

Steel-Clad Switchgear in Utility Substation



THIS installation of Reyrolle equipment is in the Bellwood substation of the Public Service Company of Northern Illinois. All switchgear in this station is of this type. The switches control six 300-amp., 2,300/4,000-volt feeders, a 15,000-kva. synchronous condenser and transfer buses for the feeders. There is no exposed wiring in this station carrying a voltage in excess of 220.

Commercial Activities and Public Relations

Rural Development Sales Program

IN THE territory lying between and served by its Elyria and Lorain divisions the Ohio Public Service Company has built approximately 100 miles of farm lines, to which are connected 550 rural customers. Like nearly all farm lines, these extensions are not bringing the desired amount of revenue, and the company has set up a definite merchandising plan to develop greater use of electrical energy by present customers and to sell the service to other farmers within reach of the lines but not yet connected. The company estimates that only one-third the available customers are using service.

The following program with recommendations as to method of procedure has been adopted and will be followed throughout the entire year:

OHIO PUBLIC SERVICE COMPANY'S RURAL DEVELOPMENT PLAN

I. Promotion Work, Good Will, Stimulating Interest.

1. Become acquainted with county farm bureaus.
2. Obtain the support of the head of county granges.
   a. Arrange talks before grange meetings and the farm institutes.
   b. Bring out the work of National Committee on Relation of Electricity to Agriculture.
      1. Ohio Public Service Company is a leading member.
      2. Is following closely the committee's advice.
3. Literature to be sent to rural communities stimulating interterest in electricity.

II. Permanent Rural Display of Motor-Driven Farm Equipment.

1. Select the largest farm equipment dealer in town to handle the display.
2. Fit up section of his store for display.
   a. Alternative: Devote section of Ohio Public Service Company's floor space to display, using local farm equipment dealer's equipment.
3. Make connections with motor manufacturers for loans of appropriate motors for farm display.
4. Prepare mailing list of rural community in preparation for sending literature pertaining to display.

III. Display Arrangements.

(To be arranged with farm equipment dealer.)

1. He is to stand no expense except the help and labor of his men in setting equipment up.
2. Ohio Public Service Company to have display wired for motors and proper lighting installed.
3. All expense incidental to setting up display cared for by Ohio Public Service Company.
4. Window display of equipment to be cut in on flat rate.
5. Electric sign over equipment dealer's store advertising display to be paid for by Ohio Public Service Company.
6. Window display at company's office.
7. Newspaper advertising on rural display, its opening dates, featuring equipment dealer's products to be at company's expense.
8. Equipment dealer is to have full commission on everything sold, Ohio Public Service Company wishes revenue only.
9. Ohio Public Service rural department is to work the entire year on working up prospects and helping equipment dealer dispose of his goods.

IV. Benefits to Company.

1. Increased revenue from rural extensions through the medium of the equipment dealers.
   a. Customers.
   b. Prestige among the farm element.
   c. Staff of salesmen working with company.
2. Building good will and acquaintances for the farms by means of an introduction and the support of a reliable farm equipment dealer who does business with the farmer constantly.

Practical Lighting Taught at Louisville University

INTELLIGENT application of illumination principles has become increasingly important with the growing public demand for better lighting, and the creation of lighting schools at different centers throughout the country has proved to be a most practical way of supplying such information. One example is afforded at Louisville, Ky., where a lighting class was established under the auspices of the Electric Club co-operative committee at the Speed Scientific School at the University of Louisville.

This illumination course was given for the benefit of all those directly interested in lighting and lighting problems to furnish a background of illuminating engineering principles to lighting specialists, fixture salesmen, dealers, factory managers, maintenance engineers, architects, designers, builders and central-station company representatives.

Lectures and demonstrations of lighting fundamentals, practical illumination design and commercial aspects of proper lighting were given by nationally recognized illuminating engineers.

Although sponsored by the Electric Club of Louisville, this course was made possible through the co-operation of the Louisville Gas & Electric Company, the University of Louisville, the National Lamp Works, represented by Walter Sturrock and E. W. Commery; A. F. Loewe, representing the Edison Lamp Works, and the Westinghouse company.

All branches of the industry attended the school, and there was an average attendance of approximately 35.

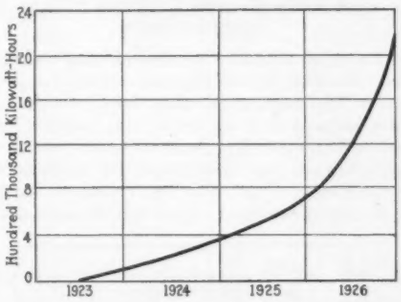
Benefit of Holding Company Commercial Department

Increases of 29 per Cent in Connected Load, 89.5 per Cent in Energy Sales and 116 per Cent in Revenue Effected in Six Years of Centralized Administration

AN EASTERN holding company with headquarters in a centrally located city operates a group of gas and electric utilities, including both scattered and interconnected properties. Until 1920 commercial development, although fairly active, was considerably limited by lack of proper organization and co-ordination of work between headquarters and subsidiary offices. In that year a sales department was organized along modern lines in the headquarters city; new business was developed with vigor and foresight through the co-operation of the headquarters sales staff with the local companies, and rapid expansion followed in revenue, in connected loads and in the sales department itself. Executive support of departmental expansion and policies enabled much of this healthy growth to be realized, and the result of the first six years' administration of this department and of the improved team play accorded by the subsidiaries led to a 29 per cent increase in connected power load, an 89.5 per cent increase in power kilowatt-hours sales and a 116 per cent increase in power revenue in thirteen subsidiaries or centrally managed properties.

In the summer of 1923 an illuminating engineering department was organized within the headquarters office of the sales department, and three and one-half years service applied to these companies added 2,400,000 kw.-hr. in sales for commercial and industrial lighting, while the total lighting sales of these companies increased in the six years more than 400 per cent. The growth of the illuminating engineering department's new business is shown in the accompanying curve, which clearly reveals the cumulative effect of intensive and sustained sales effort in the acceleration of commercial lighting consumption on departmental recommendations since 1925.

It is interesting to note that the average rate per kilowatt-hour sold for power increased from 2.36 to 2.7 cents during these six years, whereas the average rate paid for lighting decreased from 11 to 9.97 cents. One of the major duties of the new sales organization at headquarters was to study rates and contracts, and as the latter expired, to negotiate renewals. New power contracts also were designed by this department. It was found that in a considerable number of cases the



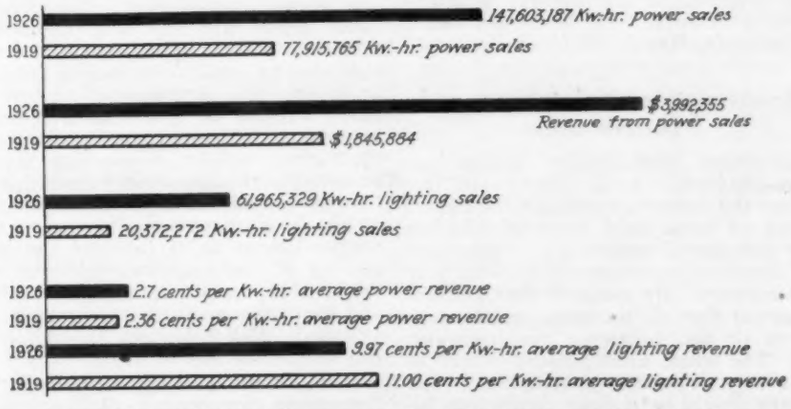
LIGHTING BUSINESS IN FOUR YEARS OPERATION

power contracts had originally been prepared either under conditions that had since changed to make these unprofitable or that the contracts had never been satisfactory when judged from the economic viewpoint. Therefore the sales organization of the headquarters office was obliged to negotiate some very difficult new agreements with the power customers as the old contracts expired, and the outcome was the above-mentioned average rate increase for the total business, amounting to about $500,000 in 1926 on the power sales of that year as compared with the rate in effect just before the department was organized.

The advantages of holding company methods were illustrated in the procedure in this work of contract renewal. The organization approached the unprofitable customers with the utmost frankness, and in a noteworthy case, which involved a very large industrial plant running at times 24 hours per day, prepared a complete analysis of the cost of service on the existing rates and demonstrated to the conviction of the customer's board of directors that the rates were 25 per cent too low to be fair on renewal. In the course of this analytical work it was necessary for the holding company's engineering department to prepare a detailed estimate of the cost of building and operating an isolated plant capable of handling the mill's business, and this involved an informal plant design of no mean proportions.

Negotiations were begun months before the original contract expired and were concluded on the basis of a just increase for the local company which supplied the industrial establishment and with excellent relations between the management of the local company, the customer and the holding company. It would have been practically impossible for the staff of the local company to have negotiated such a new contract under the circumstances, because this utility was too small to afford the specialized ability required as a part of its local organization; but through centralized management and on a fee basis small indeed for the results obtained, the local company was enabled to obtain a renewal that turned business being handled at a loss into business yielding a fair profit, and with continued excellent relations to its customer.

A comparison of the last year's operations of these thirteen utilities before the organization of the industrial sales department with the results in 1926 is shown in the accompanying chart.



ANALYSIS OF COMMERCIAL RESULTS OF GROUP OF THIRTEEN COMPANIES
Holding company commercial department established in 1920.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Economic Value of Increased Steam Pressure.—H. L. GUY.—As presented here this is an abstract of a paper read before the Northwestern branch of the Institution of Mechanical Engineers (England). The paper reports some results of investigations on the effects of steam-pressure increase on operation and plant efficiencies and costs, with consideration of the selection of particular pressures for use.—*Electrical Review (England)*, May 6, 1927.

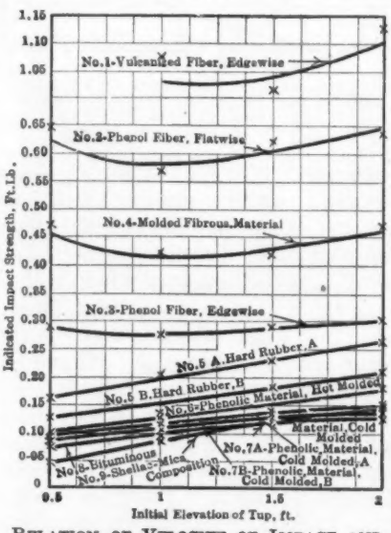
Recent Extensions at Treforest Power Station.—This article deals with the recent opening of the extensions of the power station of the South Wales Electrical Power & Distribution Company. The general system of generation and transmission is alternating current, three-phase, at 11,000 volts. The total mileage of distribution lines is 211, of which 102 miles are overhead and the remainder underground. In order to provide for future developments, it was decided to consider the present system of feeder conveyance as it existed in 1923 practically as a distributing system and to design and gradually carry out a new system of feeders connected with this network, supplying it at appropriate points. A radial system of feeders has been designed, stepping up to 33,000 volts at the power station, with transformer substations stepping down to 11,000 where connections are made to the distribution system. Growth of demand led in 1920 to the placing of an order for an 18,750 kw. turbo-alternator for a steam pressure of 350 lb. per square inch. This was the first of the new extensions. When the reconstruction and replacement is completed the station will hold six sets, ranging from 16,000 kw. to 25,000 kw. in output, with corresponding equipment of boilers and auxiliary plants. The thermal efficiency of the station has been a matter of special consideration, the design being such as to provide for the highest continuous thermal efficiency under all conditions of load. Charts accompanying this article indicate the practical results achieved. — *Electrical Times (England)*, May 5, 1927.

Transmission, Substations and Distribution

Practical High-Tension Mains System Diagram.—A. E. ROOTS.—In this paper the author emphasizes the importance of some good form of diagram for adequately outlining the extension of electrical transmission systems over the country. He contends that an ideal diagram for all purposes should conform to the following requirements: (1) The whole arrangement should be as nearly as possible geographical. (2) There should be a clear distinction between transmission lines of different pressures. (3) Internal connections at substations and power stations should be clearly shown. (4) Diagrams should embody some form of mechanical indicator to show position of switches (open or closed), also indicating type of switch, such as automatic oil-break type, non-automatic oil-break type, air break, switchgear, etc. (5) The whole scheme should lend itself easily to the inevitable alterations which frequently take place on all systems.—*Electrical Times (England)*, May 5, 1927.

Units, Measurements and Instruments

Impact Testing of Insulating Materials.—W. W. WERRING.—This paper is a discussion of the application of the impact test to insulating materials and of the development of low-capacity, pendulum-type machines of sufficient sensitivity for the purpose. Both Charpy and Izod type tests are discussed and comparative data shown. Results of static flexure tests of both plain and notched bars are given in comparison with similar impact test results. The effect of initial energy of impact and initial velocity of impact are shown graphically. The conclusions drawn are (a) that insulating materials possess impact properties not indicated by static tests even of notched bars, (b) that a comparative test of either Charpy or Izod type will probably be satisfactory in this field, (c) that great weight of machine is not essential in the capacities required, (d) that the magnitude of the initial energy of impact is of little significance to the results except as it involves the sensitivity of the machine, (e) that the velocity of impact is of great effect and that standardization of velocity is essential.—*Bell Telephone Laboratories, Reprint B-242, March*, 1927.



RELATION OF VELOCITY OF IMPACT AND INDICATED IMPACT STRENGTH

Million-Volt Testing Laboratory.—HERMSDORF-SCHOMBURG.—A large German ceramic concern has recently finished its new high-voltage testing laboratory, which contains two 500-kv., 800-kva. testing transformers, each with one pole grounded. Each oil-filled transformer weighs 50 tons and measures 21 ft. in height. The two transformers stand in relatively small rooms, from which horizontal wall bushings lead into the testing laboratory proper. A three-phase to single-phase motor-generator furnishes 800 kva. at 5,000 volts and 50 cycles. A sphere gap with 75-cm. balls serves as a voltmeter. Remote-motor control is provided for the setting of this gap. High frequency for impulse testing is obtained from a special Tesla-type transformer. Provision has been made in an adjoining hall to conduct tests with traveling waves on a line 175 ft. long. Alongside of the laboratory an open space of 110 ft. x 175 ft. has been set aside for outdoor tests. An exterior balcony on the building permits control of the transformers in the latter case.—*Elektrotechnische Zeitschrift*, April 14, 1927.

Generation, Control, Switching and Protection

Protective Relay.—B. THIERBACH.—This article describes a relay which, it is claimed, protects transformers of the oil-immersed type against electrical damages. By far the greatest number of transformer failures can be attributed to one of the following causes: (1) excessive local heating, (2) short-circuit of iron laminations, (3) flash-over between leads or leads and ground. All of these causes will dissociate the oil, with ensuing gas generation in the shape of bubbles. This new Buchholz relay attempts to catch these bubbles and pass them toward a float, changing thereby their buoyancy. This in turn changes the position of the float, causing a mercury or ball contact to close an alarm or a trip circuit. It is suggested that the relay be mounted in the connecting pipe between transformer and conservator. A number of cases are described from which the protective value of the relay becomes apparent. How the gas bubbles are directed positively into the small connecting pipe from the transformer to the relay is not explained in the article. — *Zeitschrift des Vereines Deutscher Ingenieure*, April 2, 1927.

Mechanical Rectifier.—F. TELLERT.—To derive relatively small amounts of direct current from an alternating-current supply, as for the charging of radio storage batteries, a new model of mechanical rectifier has been placed on the market which is of the non-polarized synchronous pendulum type. Built as a twin unit, utilizing both half-waves of the alternating current and in conjunction with a special high-leakage transformer, the new type reaches an over-all efficiency of 85 per cent and is available for as high as 300 watts. It can be made for charging A or B batteries, or both simultaneously. Careful and positive adjustment of the contacts reduces sparking to a minimum and obviates radio interference. The paper contains oscillograms to show not only the rectification but also the shape of the resulting direct current. To forestall idle operation of the swinging reeds from the

direct-current side in case of an interruption of the alternating-current supply, larger rectifiers of this type are protected by a reverse-current relay.—*Elektrotechnische Zeitschrift*, April 7, 1927.

Illumination

Oakland Protects the Pedestrian in Its New Traffic Control.—This article describes the traffic control system designed so that the pedestrian may know definite'y that he must also abide by traffic signals. The system uses a three-light signal with vibrating bell hung on brackets at the four corners of each intersection and visible from each of the sidewalk corners. The top light is a red one, marked "Stop"; the next light is an amber one with a plain marking, "Ped'n," standing for "pedestrian." The bottom light is a green one, marked "Go." A particularly interesting feature of the Oakland traffic control system is to be found in the switchboard in the City Hall station from which the entire system is operated. The article describes in detail the automatic equipment of this board.—*Electrical West*, May, 1927.

Electrophysics, Electrochemistry and Batteries

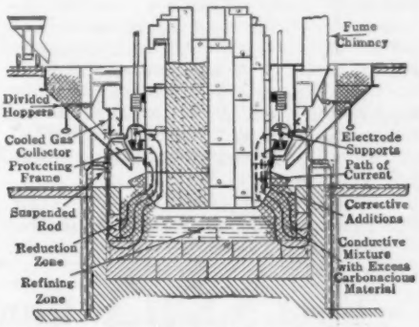
Electrochemistry of Solutions of Mixed Electrolytes.—H. S. HARNED.—The solubility and electromotive-force methods for determining the activity coefficients of an electrolyte in a solution of another electrolyte are outlined in this paper. The law of the linear variation of the logarithm of the activity coefficient is discussed from a number of points of view. The activity coefficient of strong acids and bases in some solutions is contrasted. A method is outlined for the determination of the ionic activity coefficient product and dissociation of water in salt solutions. Liquid junction potentials and individual ion activity coefficients are defined and discussed. The respective thermodynamic behaviors of the hydrogen and hydroxyl ions are contrasted with a catalytic effect. Some theoretical aspects of the results of these investigations are considered.—*Paper presented before American Electrochemical Society*, April 28, 1927.

Progress in the Art of Electrical Precipitation Since 1900.—P. E. LANDOLT.—Starting with the early researches of Lodge; Walker and Cottrell, the rapid development of electrical precipitation up to the present day is briefly recounted. Among the important steps in the advance were the introduction of the mechanical rectifier, a large-scale industrial installation at 50,000 volts to 75,000 volts, the introduction of gas humidification in 1916 and the new "graded resistance" collecting electrode in 1923. At the close of 1925 there were more than 300 Cottrell installations in operation throughout the world.—*Paper presented before American Electrochemical Society*, April 28, 1927.

Glow Test for Metals of the Platinum Group.—C. W. DAVIS.—In this paper the theory of contact cata'ysis and the factors which influence the glow reaction are discussed. Experiments are described which investigate the factors involving the nature of the support, the heating of the catalyst, temperature of gas and catalyst, kind of gas, limit of glow test and nature of the solutions. Curtman and Rothberg's method may be applied safely only in the absence of copper, cobalt, nickel or silver, according to the paper. A modified procedure is given which makes the glow reaction a more reliable test for the platinum group metals.—*Journal of Franklin Institute*, May, 1927.

Heat Applications and Material Handling

The Miguet Electrode and the Miguet Furnace.—MARCEL ARROUET.—For high-power electric furnaces, three-phase has been preferred in the past. However, the author undertakes to show that, when properly designed, large single-phase furnaces are practical and will operate efficiently. A feature of the new furnace discovered by the author is the improved continuous electrode of large cross-section. The



SINGLE-PHASE, 240,000-AMP. MIGUET FURNACE

bottom of the electrode is about 51 in. above the bath, leaving a spacious zone for carrying out reactions.—*Paper presented before the American Electrochemical Society*, April 28, 1927.

The Electric Furnace in Industry.—This article is a discussion of the application of the electric furnace to a number of processes previously considered out of its field. Apart from the consideration of price there appear to be at present two main obstacles to be overcome before the use of electric furnaces can become as general as gas, according to the author of this paper. The first is the scarcityof electrical engineers who have specialized upon the metallurgical side. An electric furnace, to be successful, has to combine the experience of the electrician and the experience of the metallurgist, and at the present time the number of instances is small of electrical training being combined with a thorough experience of the hundred and one different trades and processes to which such a plant has to be applied. The other obstacle which is yet to be overcome is the scarcity of effective publicity on the subject of what can be done by electricity in this new field. Given the necessary publicity and continued interest, recent developments show clearly that it is in the power of utility companies to develop a considerable industrial-furnace load with profit both to the user and the utility.—*Electrical Review (England)*, May 6, 1927.

Telegraphy, Telephony, Radio and Signals

Cork Broadcasting Station.—This article deals with the technical details of the new broadcasting radio-telephony transmitting station at Cork, Ireland. The power required to operate the complete station is 9 kw.; 1.5 kw. is fed to the oscillator, which, in turn, delivers 1 kw. of unmodulated power to the aërial system, so that with 100 per cent modulation a "peak" power of 4 kw. can be dealt with by the apparatus without introducing distortion. The aërial is capacitatively coupled, which secures high quality regardless of the percentage of modulation and also minimizes the radiation of harmonics of the carrier frequency, so that interference with wave lengths other than that used is reduced. The transmitter is designed for operating upon any wave length between 200 m. and 600 m. and may be changed over from any one wave length to any other within this range in about 20 minutes.—*Electrical Review (England)*, May 6, 1927.

Sensitive Alternating-Current Relay.—P. SELENYI.—Description of a polarized relay in which the operating contact is made by releasing an armature which adheres to the pole piece of a permanent magnet by the demagnetizing action of a coil. The relay is of particular use in connection with a microphone to detect far-off noises, such as the firing of artillery, or to measure sound travel. Large wooden boxes which act as sound amplifiers have been found useful accessories to actuate the detecting microphone.—*Elektrotechnische Zeitschrift*, April 21, 1927.

Miscellaneous

Experimental Electric Shock.—R. W. IAN URQUHART.—This is a treatise concerning the investigations made by Prof. J. J. R. Macleod and associates at the University of Toronto into the causes of death from electric shock and to learn what further could be done to aid in the resuscitation of its victims. Rabbits were used in the majority of the experiments. The conclusions were: (1) Death in electric shock, confirming previous deductions, may be due to primary cardiac failure, to primary respiratory failure or to a combination of both. (2) In laboratory animals, when current traverses body from head to hind leg, about 45 per cent of the deaths are of purely cardiac origin, the remainder being due to failure of the respiratory movements. (3) In these a condition of profound paralysis becomes established in the respiratory, vagus and vasomotor centers. (4) That the paralysis involves these centers is shown by experiments which demonstrate clearly the absence in electrocuted animals of reflex effects normally functioning through them. Since the nerve centers become insensitive to extraneous influences, counter-stimulation is not an aid to recovery. (5) The experiments show definitely that when the electric current does not cause charring of nerve structures the paralysis is recovered from and the reflexes return, provided efficient artificial respiration is applied.—*Journal of Industrial Hygiene*, April, 1927.

News of the Industry

N.E.L.A. Exhibition Opens

And All Is in Readiness for Fiftieth Convention Sessions Next Week—Committee Meetings on Monday—Several Additions Made to Program

TODAY (Saturday), at 1 p.m., the manufacturers' exhibition which forms part of the fiftieth convention of the National Electric Light Association will be opened on the Million Dollar Pier at Atlantic City, with more than two hundred exhibits by company members. At the same hour registration will begin, and indications point to all records for attendance being broken when the thousands of delegates and visitors from every part of North America shall have assembled.

A few important additions have been made to the tentative program as printed in the ELECTRICAL WORLD for May 14 (page 1028). Thomas N. McCarter, president Public Service Corporation of New Jersey, has been added to the speakers to be heard at the fourth general session on Thursday morning, and W. W. Freeman, vice-president Columbia Gas & Electric Company, to the speakers at the fifth general session on Thursday afternoon. United States Representative Charles A. Eaton of Plainfield, N. J., widely known as a public speaker, will address the public relations session on Tuesday afternoon, and Miss Eloise Davison, associate professor of home economics at Iowa State College, will be heard at the same meeting. In the accounting session also on Tuesday afternoon, Henry Mace Payne, consulting engineer for the American Mining Congress, will speak on "The Motive Power of Industry." The address of William Green, president American Federation of Labor, on "The Relation of the Electric Light and Power Industry to Labor," has been shifted from the Thursday afternoon general session to the session on Wednesday afternoon. Mrs. Harrison T. Baldwin of the National League of Women Voters, who is to speak at the same meeting, will take as her subject "The Woman Voter and Electric Power."

Monday will be devoted to committee meetings as follows: Hotel Traymore—Accident prevention, 9:30 a.m.; customer ownership (luncheon), 12:30 p.m.; national executive (luncheon), 1 p.m.; educational, 1 p.m.; Accounting Section executive, 3 p.m.; Commercial Section executive, 3 p.m.; Engineering Section executive, 3 p.m.; Public Relations Section executive, 3 p.m. Hotel Dennis—Women's committee, 2:30 p.m. Other special meetings scheduled are that of Class D members at the Greek Temple on the Million Dollar Pier on Wednesday at 12:30 p.m.; a luncheon meeting of the public policy committee at the Hotel Traymore on Wednesday at 1 p.m., and a luncheon meeting of state public utility information directors at the Traymore on Thursday at 1 p.m. The general sessions will begin at 9:30 a.m. Tuesday.

Electrification Plans of New York Central

The New York Central Railroad will develop power in its own generating stations at Yonkers and Port Morris to supply its contemplated electrification on the West Side of Manhattan Island, according to statements made by railroad officials to the press. Between 30,000 kw. and 40,000 kw. will be required for track now being electrified between Spuyten Duyvil and Seventy-second Street. Plans for electrification of the lines below Seventy-second Street, going all the way south to St. Johns Park in the lower part of Manhattan, are still the subject of negotiation with the city.

At the present time the New York Central has two power stations in the New York district. The largest of these is at Port Morris, in the Bronx. Here 70,000 kw. can be generated, and the major portion of the energy needed for the passenger lines of the company running north out of the Grand Central Station is supplied from this station. The second power station of the company is at Yonkers, where there is a capacity of 20,000 kw. This plant will be doubled, the new equipment being added probably within two years.

The railroad does not, it is announced, expect to purchase any power from the local companies for any part of its extensive electrification program. Current will be fed to the lines of the railroad on the West Side from three substations, each with a capacity of 5,000 kw. These stations will change the current from 11,000 volts alternating to 600 volts direct. One of these substations will be at Dyckman Street, another at 133d Street and a third at Sixty-sixth Street.

The electrification of the West Side line of the New York Central has been the subject of negotiation between the railroad and the city for a long time. In the present instance the work is being combined with the elimination of numerous grade crossings. It is predicted that the entire project will be completed by 1931.

First N.E.M.A. Convention Scores Hit

Large Attendance, Excellent Addresses from Members and Visitors, Practical Accomplishments by Divisions and Wise Counsel Mark Hot Springs Meeting

AN ATTENDANCE of more than 400 marked the first convention of the National Electrical Manufacturers' Association, held at Hot Springs, Va., on May 27 to June 3. The well-rounded program included several speakers of national reputation. General Herbert M. Lord, Director of the Budget, outlined the savings made through systematic effort to reduce national expenditures and thought that other taxing agencies could well follow the example of the federal government. President R. F. Pack of the National Electric Light Association pointed out the need for co-operation between manufacturers and light and power companies. In his opinion a selling era is at hand, and he dwelt on the point that all electrical groups have a common objective—the electrification of America. He hoped that no handicaps to greater use of electric service would be introduced through unnecessary ordinances or restrictive rules. The reorganization of the Society for Electrical Development, Mr. Pack thought, should provide a common and neutral meeting ground on which electrical groups can work together. Today the N.E.L.A. is stressing commercial development in every aspect of electric service, and it needs the co-operation of the N.E.M.A. Synchronized advertising and a common plan of selling should be worked out by the two groups. In the opinion of Mr. Pack, only an intensified use of electric service would make for continued prosperity.

Admiral W. H. G. Bullard, chairman of the Federal Radio Commission, stressed the opportunities for radio sales in the Orient and dealt with the improvement of receiving sets and sending sets so that interference in broadcasting can be minimized.

William McClellan, former president of the American Institute of Electrical Engineers, gave a well-prepared outline of standardization as a commercial tool. He described the international standards situation in detail and the moves recently made to form a workable committee to take action under the auspices of the American Engineering Standards Committee.

In the morning sessions of the several divisions much work was accomplished of value to the manufacturers. Tentative approval was given to the recommendation of the joint committee on fractional-horsepower motors. Plans were made to form an appliance

division of the N.E.M.A. The compilation of statistics in several lines of apparatus was authorized.

A feature of the meeting was an address by Earl Whitehorne, commercial editor of the ELECTRICAL WORLD, which showed that the electrical manufacturers and the utilities had a common interest in the intensified use of electric service. Selling in terms of more service and not in terms of commodities was urged. The rush of new customers demanding service is about over, Mr. Whitehorne said, and the entire electrical industry must look for continued prosperity through intensified use of energy and equipment by existing customers, especially those in the homes.

Dr. E. A. White, director of the Committee on the Relation of Electricity to Agriculture, speaking on "Three Million New Customers," expressed his conviction that there is a potential electrical load on the farm of sufficient size to insure reasonable rates in the more important agricultural regions. The farm load outside of the household, conservatively estimated, shows possibilities of reaching in five years 18,000 kw.-hr. annually per mile of line in some districts. Dr. White said he would not dare to attempt to estimate the volume of electrical equipment sales. Undoubtedly, however, a hundred thousand rural customers were added in the last year. If it cost only an average of $200 to reach each customer and only $50 per home was spent for wiring, this represented $25,000,000 for labor and materials.

A plan was announced whereby an N.E.M.A. hour of broadcasting by radio will be given. This hour will be in daylight and, in addition to entertainment and publicity features, will be designed to aid radio dealers.

In the program there were many topics of interest to the Apparatus, Radio and Supply Divisions of the association. Committee reports showed that each division has embarked upon a constructive program. Evidence was presented that broad commercial topics were to be studied as well as the technical features of equipment design and manufacture. As a mark of confidence the existing officers were re-elected for another year, including President Swope and Vice-presidents Raycroft, Murphy, Collens and Curtin. Two new governors elected were H. T. Dyett and B. E. Saulsbury.

In his address President Swope stressed the importance of unity and solidarity among electrical manufacturers and outlined the constructive work done by the N.E.M.A. Clarence L. Collens, vice-president of the Policies Division, dwelt on the importance of studying markets and of building better quality and type of sales. D. H. Murphy, vice-president of the Supply Division, urged the active participation of the N.E.M.A. in national codes work. He thought that electrical manufacturers have developed greater ability to make products than they have to sell products, and he urged improvement in apparatus and an intensified use of electric service. J. M. Curtin, vice-president of the Apparatus Division, also urged greater effort in merchandising and said that the sectional groups and their work were of greatest importance in the growth of the N.E.M.A. He urged that a study be made of distribution problems.

L. B. F. Raycroft, vice-president of the Radio Division, asserted that the troubles in the radio industry all arose from within the industry and that this division of N.E.M.A. intends to study these situations and the problem of distribution in order to be of help to the industry.

Managing Director Waller, taking as his topic "Putting Price in Its Place," entertained his audience by the recital of a number of homely and amusing examples, ranging from fishing trousers to insurance, to show the relation of price to value and the factors entering into any analysis. Applying his observations to the electrical industry, he said:

"The system described, with variations to suit, may be used in connection with buying or selling almost any kind of apparatus imaginable. I have applied it to the purchase of sand-blasting machinery, electric furnaces, electric motors, bank stock and automobiles. It puts price in its place simply because it makes price one of a number of essential points entering into a definite transaction. When the high and low extremes in competitive bids have been established, the interest immediately centers upon the spread in price. What features exist to justify the difference? It is desirable to consider this difference not only in dollars but in per cent.

"Let us say that some article is 10 per cent above the market in price. What does that mean in dollars, and then, are we justified in paying that number of dollars for the advantages offered? . . . Finally, can a comparison of this kind be made by any one or is special training required? On the question of the purchase or sale of material any one can do it who will first find out what are the essential points and then take the trouble to get exact information in regard to them.

"Such a study serves several purposes, among which are: (1) Informing itself as to the actual work he has in hand; (2) selling his product to himself on an 'index' basis; (3) development of a realization that price in its place is only one necessary item relating to a transaction, and not the predominating feature. Probably a purchasing agent or a salesman could profit by discussing with his engineer the points to be investigated for a certain product. There is in addition a source of information which may outrank all others in practical value. I refer to the user. If you want to find out exactly what is the matter with any particular device and how it can be made better, ask the man who owns one and having asked him find out whether he is right or not."

Technical papers on various aspects of the industry were read and discussed and important progress was announced by several committees. Entertainment and social features were accented at the meeting as part of a policy of promoting personal acquaintance among manufacturers.

Power Board Activities

Jurisdiction Taken Over New River and Upper Tennessee—Plans for Pulp Manufacture in Alaska

AS INTIMATED last week, the Federal Power Commission holds that a power development on New River near Radford, Va., comes within its jurisdiction. This action was taken at a meeting of the commission on June 1 in connection with a declaration of intention filed by the Appalachian Electric Power Company, which proposes to construct a dam 1,600 ft. long and 115 ft. high. A reservoir 19 miles long with a storage capacity of 100,000 acre-feet will be formed. The commission did not take jurisdiction, however, over a small development in the North Fork of New River. S. A. Lawrence of Cleveland proposes to construct a dam 25 ft. high at a point near Weaversford, N. C. The capacity of the proposed reservoir and the fact that it is 246 miles above the head of navigation led to the conclusion that the development would not affect the navigable capacity of the Kanawha River.

A preliminary permit was authorized covering a 6,000-hp. project on the Santa Fe River in Florida which is to be developed by the Florida Power Corporation. A preliminary permit had been issued on Nov. 17 to the Fitkin Utilities, Inc., for this project, but as the original applicant had sold its rights to the Florida Power Corporation the original action was rescinded.

A preliminary permit was granted to George T. Cameron of San Francisco to cover a 100,000-hp. project involving a number of small lakes and creeks in the Tongass National Forest near Juneau, Alaska. The permit contains a condition requiring the acceptance of the timber award approved by the Forest Service. Another permit was authorized for I. and J. D. Zellerbach of San Francisco covering a 40,000-hp. project on nine creeks on Revillagigedo Island in the vicinity of Ketchikan. The entry of these two groups into the field of pulp manufacture in Alaska will mark the beginning of that industry in the territory.

The preliminary permit issued to the Prairie River Power Company on May 28, 1925, covering a project in Minnesota on the upper Mississippi River, was extended for one year, and a similar extension was granted the Kentucky Hydro-Electric Company on a permit issued May 28, 1925, covering a project on the Kentucky River involving the use of Dams Nos. 1 to 7.

The permit issued the Illinois Northern Utilities Company of Dixon, Ill., on June 16, 1926, covering a project on Rock River in Ogle County, Ill., was canceled. This was done at the request of the company, owing to the fact that it was unable to acquire the necessary land on which to construct project works.

Licenses were authorized covering nine constructed projects of the Utah Power & Light Company. The names of the plants involved are Oneida, Logan, Santaquin, Alpine, Battle Creek, Upper and Lower American Fork, Paris, Stairs, and Upper and Lower Mill Creek. All of these plants have

been in operation from ten to thirty years. The plants were constructed or their construction begun by other companies prior to their acquisition by the Utah Power & Light Company. A license also was issued covering 266 miles of transmission lines.

The license of the Hydraulic Race Company, covering a diversion of water from the Niagara River through the New York State Barge Canal for use along Eighteen-Mile Creek, was extended for a period of six months to Dec. 13, 1927.

High Court Bars Power Issue in Chicago Canal Case

In a brief decision rendered May 31 by Justice Van Devanter the United States Supreme Court upheld the motion of the State of Illinois and the Sanitary District of Chicago to strike a paragraph from the suit of the State of New York involving the diversion of water from Lake Michigan. In its suit New York State alleged that diversion of water through the Sanitary Canal at Chicago was detrimental to the interest of New York in various ways. One paragraph alleged that diversion tended to prevent development for power purposes of the Niagara and St. Lawrence Rivers. Illinois and the Sanitary District moved to strike out this allegation as indefinite, and the Supreme Court has allowed the motion on the ground that New York now is not being injured in power development on an international stream and that such development as may be made in the future will be a matter for agreement between the United States and Canada, thus rendering the question at present a purely abstract one.

Canadian Electrical Men Meet at Niagara Falls

J. B. Woodyatt of the Southern Canada Power Company of Montreal was re-elected president of the Canadian Electrical Association at the conclusion of its convention held at Niagara Falls, Ontario, on May 25, 26 and 27. The convention, which was devoted to the consideration of reports of committees, was addressed by Paul Clapp, managing director of the National Electric Light Association, on May 26.

A remarkable case of resuscitation from electric shock was reported by the accident prevention committee. A man shocked and burned was removed from a pole and worked on for eight hours, signs of life being noted at intervals during that time, before breathing was restored.

Inspection trips were made to the power plants at Niagara Falls and at De Cew Falls, Ontario, and an interesting exhibit of electrical apparatus and appliances was given during the week at the Clifton Hotel, where the meetings were held. Vice-presidents were elected as follows: H. B. Pope of the Montreal Light, Heat & Power Company; G. Gordon Gale of the Gatineau Power Company, Hull, Quebec, and P. S. Gregory of the Shawinigan Water & Power Company, Montreal.

Purchases and Mergers

Maryland Commission Refuses to Permit Absorption of Four Small Companies—Movements Elsewhere

PERMISSION asked by the Electric Public Utilities Company of Chicago, as reported last week, to absorb the Lonaconing, Emmitsburg, Antietam and Midland electric companies in western Maryland has been refused by the Maryland Public Service Commission. The would-be purchaser will, it is understood, in all probability appeal to the courts. The commission held the proposed price to be excessive, and after dismissing the application it filed charges that the rates of the four companies are "excessive, unjust and unreasonable."

The Maryland Public Service Commission was to give a hearing on Friday, June 3, to a petition of the Consolidated Gas, Electric Light & Power Company of Baltimore for permission to take over control of the Washington, Baltimore & Annapolis Electric Railroad Company through the medium of a holding company, the Baltimore Corporation. The deal would involve more than $1,000,000 and would give the Baltimore company 54 per cent of the railroad stock. If the petition is approved, the purchasing company will control the electric supply between Baltimore and Washington, from the Chesapeake Bay to some distance west of Howard County, by acquiring a subsidiary of the Washington, Baltimore & Annapolis company. This subsidiary, the Annapolis & Chesapeake Bay Power Company, supplies power to Annapolis and parts of Anne Arundel County. The Washington, Baltimore & Annapolis now buys its power from the Potomac Electric Power Company of Washington, under a contract which has six years to run.

The New York Public Service Commission has granted the petition of the Empire Power Corporation for permission to acquire all of the outstanding capital stock of the Tracy Development Company, which owns a hydro-electric plant at Waterloo, Seneca County, and which has been operated under lease for some years by the Empire Gas & Electric Company.

A proposal from the Northwest Public Service Company to purchase the Redfield (S. D.) municipal electric light plant and power station for $150,000 cash will be submitted soon to a referendum vote.

The Public Utilities Consolidated Corporation, with general offices in Minneapolis, has been formed to operate and manage electric, gas, water and ice companies in which the W. B. Foshay Company holds a controlling interest. Properties in several states now being operated by this company will be taken into the new corporation as subsidiaries. Vermont properties serving seven towns will be incorporated as the Public Utilities Vermont Corporation. The entire electric system serving a number of towns in northwestern Kansas will be operated as the Public Utilities Kansas Corporation, and similar corporations will be formed for properties in Arizona, Idaho, California and other states in which the corporation has or is acquiring utility interests.

According to advices received by the Oregon Public Service Commission, the West Coast Hydro-Electric Corporation has acquired control of the properties of the Prairie Power Company of Prairie City and the Consolidated Electric Light Company of Canyon City, all in Grant County, Ore. The Prairie Power company is a hydro-electric plant and serves 226 customers. The other utility purchases energy from the Prairie company for 98 customers. The Oregon commission has also been notified that the Jensen Light & Power Company of Lakeview, Ore., has been purchased by the West Coast Hydro-Electric Corporation.

Consolidation of five utility operating companies into the Inland Power & Light Corporation was announced on May 31 by A. E. Fitkin, president. The companies are the Kansas Power Company, Concordia, Kan.; Dalhart (Tex.) Public Service Company, Arkansas-Missouri Power Company, Missouri Public Service Company and Michigan Public Service Company. Through an exchange of stock the Commonwealth Light & Power Company and Interstate Electric Corporation have been eliminated from the structure through which the Fitkin interests control the operating companies. The Michigan Public Service Company, with headquarters at Ludington, has added the Boyne Falls Light & Power Company and the Walloon Lake Power & Light Company to its seven other Michigan properties, which have been appraised at more than $4,500,000 by the Michigan Public Utilities Commission. These companies are the Michigan United Light & Power, Ludington; Whitehall; Boyne City Electric and Boyne River Power, Boyne City; Michigan Public Service, Cheboygan; Elk Electric, Elk Rapids, and Grayling Electric, Grayling.

Control of the Northeastern Power Corporation, which, with operating subsidiaries in the northern and central sections of New York State, is interconnected with the Mohawk-Hudson Power Corporation, Buffalo, Niagara & Eastern Power Corporation and St. Lawrence County Utilities, is to be vested in the St. Regis Paper Company, controlled by the same interests.

According to reports in the Province of Quebec, negotiations are under way which may lead to the purchase of the Quebec Southern Power Corporation by new interests. Those with a knowledge of the corporation's operations neither deny nor affirm the rumor. Quebec Southern operates in a territory contiguous to that of the Ottawa-Montreal Power Company, which has just been acquired by interests which represent the International Paper Company.

Sale of Dothan (Ala.) Lighting Plant Beaten by 38 Votes

Permission to the Mayor and Council of the city of Dothan, Ala., to sell the municipal lighting plant to the Gulf Electric Company at a minimum price of $1,600,000 was refused by the people in an election held May 31, with 710 votes against and 672 for. A vote on selling the municipal lighting plant at Bay Minette, Ala., will be held June 7.

Transmission Engineering Problems Faced

A.I.E.E. Regional Convention at Pittsfield Records Technical Progress in Transforming and Insulating—Advances in Technique Apparent

NOTABLE progress in attacking important problems associated with transmission engineering was the feature of the closing sessions of the Northeastern regional A.I.E.E. meeting last week at Pittsfield, Mass. On Thursday morning W. S. Moody presided over a meeting devoted to various aspects of transformer tap changing, and on Friday morning dielectric problems held the center of the stage under the chairmanship of Prof. H. B. Smith. In the afternoon a student technical session was held under Prof. W. H. Timbie, with magnetization as the major theme, and on Saturday automatic switching, power-factor correction and transformer problems were discussed under the chairmanship of F. W. Peek, Jr.

At the convention dinner Thursday evening reminiscences of electrical pioneers from the Berkshire district were given by President Chesney and G. Faccioli, and prizes for excellent papers were awarded to S. W. Marshall, Jr., of Stone & Webster, Othmar K. Marti of the American Brown Boveri Company and J. Allen Johnson of the Niagara Falls Power Company. A large number of delegates visited the Pittsfield works of the General Electric Company during the convention and witnessed demonstrations of artificial lightning in the high-tension laboratory. There was also an illustrated lecture on "Making Light Audible and Sound Visible" by John B. Taylor, consulting engineer with the General Electric Company.

Tap-Changing Methods Flexible

Considerable diversity of opinion arose in the discussion of papers by L. H. Hill of the Westinghouse company, L. F. Blume and Arthur Palme of the General Electric Company on tap changing. It appeared that ratio changing by steps and by smooth curve have each special advantages depending on conditions, as have the parallel winding and preventive auto-transformer methods. In general, the auto-transformer method was viewed with greater favor, but the youthfulness of this branch of the art and its rapid advance into the field of heavier power transmission and interconnection emphasized the importance of exhaustive study of particular cases arising in practice. Percy H. Thomas touched upon the importance of speeding up tap-changing operations in meeting the severe requirements of service on extensive systems with considerable synchronous apparatus on duty, and it was brought out that designers face the problem of cutting the minimum from four seconds to one second or less. K. A. Oplinger pointed out that an application is under consideration in which the tap changer will automatically control the flow of wattless kva. between two generating stations in inverse proportion to the load on these plants. E. F. Gehrkens said that the step type of induction regulator should be used whenever conditions warrant, on account of its simplicity of construction and higher efficiency of operation. Two million kva. of load-ratio-control transformers are now in service or on order from one manufacturer, according to Mr. Palme.

An extended analysis of sparking in air was presented by A. Penn-Tung Sah, based on experimental and mathematical analyses of spheres and cylinders under various conditions. The paper discussed certain inconsistencies in sparking gradients, developed an approximate formula for cross-cylinders and extended the Davis theory of ionization by collision to the sphere gap.

In a paper, "A Theory of Imperfect Solid Dielectrics," M. G. Malti sought to present basic definitions of dielectric behavior, studying hysteresis, viscosity and energy losses and applying the classical theory of electrostatics. C. L. Kasson then presented a paper on high-voltage measurements on cables and insulators which emphasized the effect of shielding upon accuracy of measurements in determining the electrical characteristics of cable insulation under direct-current voltage stresses above the ionization point and showed extreme variability in the ionization point with the physical circuit and atmospheric conditions. Both paper and rubber-insulated cables were tested.

Herman Halperin, Chicago, telegraphed a discussion of Mr. Kasson's paper based on recent tests by the Commonwealth Edison Company. Several hundred samples of paper-insulated cables were tested and about 75 per cent of the failures occurred at warm spots on the lead sheathing. This percentage increased with the thickness of the insulation. A number of ionization tests on old 12-kv., three-conductor cables removed from the system gave practically flat power-factor and voltage characteristics up to about 15 kv. As the insulation was less than that on cables tested by Mr. Kasson, the stresses at which ionization took place in the Chicago cables appeared to be about three times as high as those in the Kasson direct-current kenotron tests. Professor Karapetoff thought that the profession was very much indebted to Mr. Kasson for his discovery of the effect of shielding. He declared that electrical engineers have fallen behind the physicists in regard to solid-dielectric theories. Prof. W. B. Kouvenhouven of Johns Hopkins also commended Mr. Kasson's work. The session closed with a paper by Prof. Frederick Bedell of Cornell University which presented certain lines of procedure useful in solving non-harmonic alternating-current problems.

Automatic Switching

A. H. de Goede described the recent development of automatic switching in the United States and Europe at the closing session on Saturday. European designs, he said, have followed American practice in general. The self-starting of synchronous converters has never found favor on the Continent owing to disturbances caused in the alternating-current system, frequently of small capacity. The United States has been slower to adopt mercury-arc rectifiers, on account of complications enforced by differences in operating conditions—notably temperature—but the use of such equipment is gradually increasing in this country. In recent years there seems to have been a tendency to utilize supervisory control more widely, and remote metering is coming into the picture.

In the discussion C. Lichtenberg of the General Electric Company emphasized the extreme ease with which operating men are being trained to maintain automatic switching equipment and pointed out that one-third of all switchboards for power-plant and substation use are now constructed for automatic operation. Twenty per cent saving has been achieved in Kansas City through improved voltage regulation in automatic operation of substations. At present twenty shipments per week of automatic equipment are being made from the factory and only one field engineer is required to supervise the launching of these installations.

H. S. Litchfield contributed a paper presenting a design formula for distribution circuits in relation to the most economical power factor, K. E. Gould a paper analyzing the instability of transformer banks supplying a capacity load with certain primary current harmonics suppressed, and G. Camilli a paper illustrating two methods of reducing transformer exciting current to the sine-wave basis through the use of the flux voltmeter in one case and in the second utilizing the flux voltmeter in conjunction with a crest ammeter. The author also included in his paper the theory of the crest ammeter and its applicability in conjunction with the flux voltmeter to the determination of direct-current saturation curves by means of alternating-current tests in magnetic investigations. The design and use of a magnetic and a contact instrument for the determination of short-circuit torque were treated in a paper on this topic by G. W. Penney of the Westinghouse company.

Southern Sierras Power Company Reduces Electric Rates

The California Railroad Commission announces a substantial voluntary reduction in the lighting rates of the Southern Sierras Power Company at all points for a period of one year, the arrangement made being similar to that recently announced for the Southern California Edison Company (ELECTRICAL WORLD for May 28, page 1163). The reduction, which ranges from 10 to 20 per cent in the maximum rate, is made with the hope that it will stimulate use of electrical energy to a degree that will justify its permanent retention. The Southern Sierras Power Company recently asked for a revaluation in the interest of increased rates, but its president, A. B. West, has expressed its complete willingness to make the experiment now announced.

Central-Station Power

High-Pressure Steam and Higher Temperatures Discussed by A.S.M.E. at White Sulphur Springs

A SESSION of last week's spring meeting of the American Society of Mechanical Engineers, held at White Sulphur Springs, W. Va., was devoted to central-station power, two papers in particular coming in for thorough discussion. These were "High-Pressure Steam at Edgar Station," by I. E. Moultrop and E. W. Norris, and "High Steam Pressures and Temperatures at Crawford Avenue Station," by A. D. Bailey.

John Anderson of the Milwaukee Electric Railway & Light Company championed the use of radiant-heat-absorbing surfaces, with which, he said, record combustion efficiencies have been obtained at the Lakeside plant, about 60 per cent of the heat released being picked up by these surfaces. He held high pressure to be a boon and announced that the Milwaukee company would next summer install a 1,400-lb. boiler and a 12,000-kw. turbine similar to its present high-pressure apparatus. Mr. Anderson held that steel castings are subject to leakage and that refractory water-cooled walls are undesirable for high-pressure boilers.

Professor Christie of Johns Hopkins University expressed the belief that temperatures above 750 deg. could be used in power plants inasmuch as 850 deg. and 900 deg. were used in oil refineries.

W. N. Polakov told about a study made of the power requirements in a Southern paper mill where it was found that the superposing of a high-pressure turbine and boiler upon the existing 175-lb. installation would permit the elimination of the purchase of 40,000,000 kw.-hr. yearly as well as a fuel saving of $160,000.

In high pressure lies the solution of the cheap power problem, Francis Hodgkinson, Westinghouse Electric & Manufacturing Company, declared, and fixed charges would determine how high it would be economical to go. There was no reason why high pressures should disturb the turbine design, but he could not be so confident about how present materials would stand up in high-temperature service. Large machines cannot undergo the distortion permissible in small parts.

George Orrok expressed the opinion that economics, and not thermodynamics, would always dictate the working conditions. Undoubtedly, there were still some "bugs" to be eliminated in high-pressure work. In regard to the Benson boiler he had seen one in Germany after it had undergone 4,000 hours of service at 850 deg. F. The alloy-steel superheater tubes showed no signs of erosion.

H. W. Leitch, United Electric Light & Power Company, New York City, said that in the Sherman Creek station when two water-cooled side walls were installed, and radiant superheaters were put on the rear walls of boilers using pulverized coal, fine ash deposits formed on the walls. These produced a slight insulating effect, and the film grew until an equilibrium was established between heat absorption and reflection. A large amount of reflecting power was retained by this coating, making it apparent that erroneous deductions might be drawn as to the actual temperatures, since a temperature of 2,400 deg. F., the fusion point, existed but a few inches from the metal surface, which was at about 1,600 deg. F.

Interesting fuel, oil-power and industrial-power sessions were also held.

Cortelyou Heads Committee of Utility Associations

George B. Cortelyou, president of the Consolidated Gas Company of New York, has been elected chairman of the Joint Committee of National Utility Associations, representing the gas, electric and street-railway industries of the United States. Philip H. Gadsden, vice-president of the United Gas Improvement Company of Philadelphia, was elected vice-chairman and chairman of the executive committee. Stephen Davis, formerly judge of the Supreme Court of New Mexico and solicitor of the Department of Commerce, has been appointed counsel of the committee. Accompanying this announcement was the following statement from Mr. Cortelyou:

"The Joint Committee of National Utility Associations was organized soon after the war ended. It succeeded the National Committee on Public Utility Conditions which was organized during the war to meet the new and complex problems then thrust upon the utility industry. That commitee, composed of P. H. Gadsden as chairman, E. K. Hall and H. H. Crowell, not only rendered very effective service to the public but enabled the industry to cooperate with the government in all matters looking to the prosecution of the war. It was in recognition of the great value of co-ordinated effort in all matters affecting the industry as a whole that the joint committee was formed on the discharge of the national committee at the close of the war. The joint committee is representative of the Amerian Gas Association, the National Electric Light Association and the American Electric Railway Association."

"Industry Interdependence" Discussed at Chicago

Speaking on "Industry Interdependence" at the quarterly luncheon of the Electric Association, Chicago, held at the Palmer House on May 26, before a gathering of more than 500 electrical men, Joseph A. Fowler, past-president Association of Electragists International and head of the Fowler Electric Company, Memphis, made a strong plea for the general adoption of a national viewpoint and the abandonment of the ineffective localized effort which now prevails. Regretting that of 18,000 contractor-dealers in Chicago only 50 are members of the Electric Association, which, he held, should serve as a clearing house for all electric problems, Mr. Fowler pointed to the situation in California, where all groups operate in harmony and the contractor is an acknowledged leader.

Favor Electric Welding

Agitation in New York Against Noise of Riveting in Building Operations Calls Attention to It

RIVETING operations on skyscrapers and other steel-frame buildings, with the incessant racket that attends them, have for many years brought forth complaints from the public whose auditory nerves are assailed and from hotel managers and landlords the rentability of whose property is injured. Fresh emphasis has in the last week or two been lent to their attacks by a campaign instituted by Health Commissioner L. I. Harris of New York City to reduce the din of construction operations. This has brought renewed attention to the advantages of welding, which, it is asserted by experts, not only eliminates noise and consequent loss of income to property owners, but is at least equally strong with riveting and, it is declared, cheaper. Gas welding has its advocates, as has pressure riveting, but the process most prominently mentioned is electric welding. A letter sent to Commissioner Harris by J. C. Curtin, vice-president Apparatus Division, N.E.M.A., quotes Gerard Swope, president General Electric Company, as saying in this connection:

"Some buildings have already been erected using electric welding. The advantages are a reduction in steel sizes because provision in strength does not have to take into consideration holes for the rivets, reduction in cost of handling because engineering layouts showing detail of rivets will be unnecessary and steel can be shipped directly from the mill, reduction in cost of assembly, and an advantage of inestimable value, the almost total elimination of the noise now attendant on the riveting of steel structures."

J. F. Lincoln, general manager of the Lincoln Electric Company of Cleveland, a pioneer in this field of construction, who has, with the sponsorship of the American Society of Mechanical Engineers, offered prizes of $17,500 for the three best papers on improvements in the art of welding (see ELECTRICAL WORLD for Jan. 22, page 228), is also quoted, as follows:

"Since electric welding has been successfully used in the construction of buildings for the last ten years, there should be no obstacles to the rapid development of this art. We built a five-story building in 1916, using electric welding, and our cost records showed that a properly managed job reduced the cost, including steel fabrication and erection, by at least 10 per cent. Improved skill in welding and a growing education of the trade should decrease the cost still further. May I also point out that the hazard to life is also probably reduced, since one man with an electric welder can do what four men did with rivets, and do it quietly?"

The Westinghouse Electric & Manufacturing Company has completed two steel buildings by electric welding and has a third under construction, Vice-president W. S. Rugg informed the N.E.M.A. All are in Pennsylvania, the largest being of the mill type, five stories high, 220 ft. long and 70 ft. wide. Tests conducted by the Carnegie

Institute of Pittsburgh demonstrated, he said, that welding can be fully as strong as riveting.

Power in Western Canada

Controversy Looming Between Manitoba and Ontario—Lake of the Woods Suit—Nipigon System Expands

PROSPECTS of additional power development in the area east of Winnipeg, Manitoba, which are being discussed are likely to result in much controversy before any definite projects emerge. The city of Winnipeg will be in line for another power plant, and if the consumption keeps increasing at its present rate and the provincial Power Commission maintains its policy of extensions, it may not be long before the Manitoba Power Company is in the field with another project. In the meantime, however, western Ontario, and particularly the town of Kenora, served by the Keewatin Power Company, is averse to Manitoba interests making further invasions into Ontario. Manitoba, they contend, has plenty of power sites of its own, and the export of power either to that province or across the international border is opposed by Kenora, where the local board or trade has passed a resolution urging the Ontario government to take steps to protect Ontario's interests. Application has been made to the Dominion government for a power site at White Mud Falls on the Nelson River in northern Manitoba. The site is a valuable one, and the city of Winnipeg may put in a conflicting claim.

The controversy between the Lake of the Woods Milling Company and the Backus interests touching the rights to hydraulic power from the waters of the Lake of the Woods has finally, after eleven years, come before the Canadian courts. The action has been taken by the Keewatin Power Company, controlled by the Backus interests, which seeks to prevent the Lake of the Woods Milling Company from diverting water from the lake through its lands and premises and from other interferences with what the Keewatin Power Company alleges are its rights. The power company also claims damages on account of water diversion, which, it alleges, has impaired its water powers.

Engineering plans are now being put into effect whereby the Nipigon Hydro-Electric System at the Head of the Lakes will have its present development of 75,000 hp. expanded to its potential development of 260,000 hp. in a comparatively short time. These plans include the development of 55,000 hp. at Alexandria Landing, which is to be available in the fall of 1928, and the development of 100,000 hp. at the Virgin Falls and Portage Landing sites. The growth of the Nipigon system since its inception has been remarkable. Of late the feeling at the Head of the Lakes has been that the Ontario Hydro should take every precaution to safeguard against any possible power shortage in that district. Only recently a deputation from Port Arthur and Fort William pointed out to the commission that the Great Lakes Paper Company, which now requires 8,000 hp., expects to require 20,000 hp. at an early date, and that the Nipigon Paper Company, which takes about 3,000 hp., anticipates boosting its power requirements to 10,000 hp. in the near future. On top of that, in the past few months, there has been a constant inquiry from industries regarding power facilities in that region.

New York Attorney-General to Study Water Power Abroad

New York State's Attorney-General, Albert Ottinger, who, as a member of the New York Water Power Commission, has consistently contended for private development and has opposed Governor Smith's stand for development under state auspices, has sailed for Europe, where he expects to gain information through the study of water-power plants, particularly in Sweden and Norway.

Mr. Ottinger said, just before sailing, that as a result of negotiations carried on with the Federal Power Commission through Charles E. Hughes, acting as a special assistant attorney-general, concessions had been obtained virtually recognizing every claim made by the state with regard to control over water-power resources within its boundaries. The concessions, Mr. Ottinger said, were regarded by Mr. Hughes as a substantial victory, won without litigation.

Arizona Utilities Association Meets at Flagstaff

Formation of a committee on public utility information and the perfection of closer affiliation with the Pacific Coast electrical and gas associations were among the principal achievements of the annual convention of the Arizona Utilities Association in Flagstaff, May 26. Every section of Arizona was represented at the meeting, and several were in attendance from Texas, California, Colorado and other points.

A. F. Moriarity, sales manager Central Arizona Light & Power Company, Phoenix, spoke on central-station merchandising; N. R. McKee, Southern Counties Gas Company, Los Angeles, on gas refrigeration, and economical 40,000-volt pole-line construction was the subject of a talk by T. E. Haycock, Arizona Power Company, Prescott. George E. Lewis of Denver, manager Rocky Mountain Committee on Public Utility Information, spoke on the information committee movement; L. M. Klauber, San Diego Consolidated Gas & Electric Company, told of recent developments in oil and gas generation; Roy H. Felt, Salt Lake City, discussed poles and "Penetrex" treatment, and Samuel H. Taylor recounted the activities of the Pacific Coast Electrical Association, of which he is secretary.

A round-table discussion of various problems of the utility industry was a noteworthy feature of the conference. W. C. Hornberger, general superintendent Central Arizona Light & Power Company, Phoenix, succeeds George T. Herrington of Flagstaff as president; M. A. Pooler of the Tucson Gas, Electric Light & Power Company will be first vice-president and L. V. Sears second vice-president. The next convention will be held at Prescott.

Briefer News

"Festival of Lights" for Niagara.—Niagara Falls, N. Y., is to have its annual "festival of lights" on the evenings of June 9 and 10. Nearly every industry in the city is expected to enter an electrically illuminated float, and the 3,500,000,000-cp. searchlamps used on Niagara Falls will be turned upward to aid the spectacle.

West Penn System Honors Veterans.—Twenty-five employees who have just completed twenty years of service with one or another of the companies composing the West Penn System in Pennsylvania were honored at Pittsburgh on May 26, when a banquet was given them under the auspices of the West Penn Section of the N.E.L.A. There was an attendance of 1,100. The principal address was made by H. Hobart Porter, president of the American Water Works & Electric Company.

Large Automatic Substations for Public Service Company of Oklahoma.—By the time the two-million-dollar power plant being built at Weleetka, Okla., by the Public Service Company of Oklahoma and the high-tension transmission line to it from Henryetta are completed two of the largest substations in the state will, according to C. H. Kretz, vice-president Oklahoma Power Company, be in readiness. These will be erected at Okmulgee and Henryetta respectively and will be under automatic control.

Business Schedule Arranged for Northwest Association Meeting.—The program for the 1927 convention of the Northwest Electric Light and Power Association, to be held in Salt Lake City on June 21 to 24 inclusive, has been arranged for morning business sessions as follows: Tuesday, general session; Wednesday, Commercial Section; Thursday, Accounting and Engineering Sections; Friday, Public Relations Section and general session.

Memorial Services for Colonel Byllesby.—In tribute to Colonel Henry Marison Byllesby, founder of H. M. Byllesby & Company, Henry Marison Byllesby Post No. 552 of the American Legion conducted a Memorial Day service on Friday afternoon, May 27, at the Illinois Theater in Chicago. John J. O'Brien, president H. M. Byllesby & Company; Robert J. Graf, first vice-president; Major-General George H. Harries, vice-president, and Bishop Herman Page of the Episcopal diocese of Michigan made addresses, and appropriate music was furnished. About 600 persons attended.

Rochester Gas & Electric to Install New Unit in Genesee Hydro Plant.—Construction of the foundation for a 23,000-hp. hydro-electric generator is now in progress at Station No. 5 of the Rochester Gas & Electric Corporation, below the lower falls of the Genesee River. This generator will be used to

take advantage of an additional flow of water made possible by completion of the Court Street dam. It will replace four old waterwheels with a total capacity of 11,000 hp., according to Roger De Wolf, assistant superintendent of the electrical department of the company.

Tonawanda Extends Buffalo's Illumination.—Fifteen hundred ornamental lamps are being installed on Delaware Avenue in Tonawanda by the Tonawanda Power Company. They will prolong the brilliantly lighted highway that now extends 10 miles north from Buffalo to Tonawanda.

Agricultural Engineers Elect Officers.—The American Society of Agricultural Engineers has elected Col. O. B. Zimmerman, experimental engineer with the International Harvester Company, as president, to take office following the St. Paul meeting on June 22 to 25. Arthur Huntington, public relations engineer, Iowa Railway & Light Corporation, will be first vice-president; Deane G. Carter, professor of agricultural engineering, University of Arkansas, second vice-president, and Raymond Olney, St. Joseph, Mich., secretary and treasurer.

Progress on Southern Power Company's High Rock Dam.—Latest official photographs made of the Southern Power Company's new dam at High Rock, near Lexington, N. C., show that progress is rapid. Several of the concrete sections are virtually finished, and the power-house structure is well on the way toward completion. It is expected that the basin will be ready to catch the surplus flow of the Yadkin and tributaries as soon as the gates can be closed at High Rock. This plant, which is to have an output of 40,000 hp., is being built by the Tallassee Power Company of Badin, N. C.

Connecticut Company Fights Delay in Hydro Development Plans.—The Connecticut Light & Power Company has petitioned the Superior Court at New Haven for permission to proceed with the construction of its hydro-electric power plant on the Rocky River at New Milford, Conn., regardless of appeals to the Supreme Court regarding the condemnation of land involved. The company holds that a clause in its charter should permit the continuation of work. General statutes of the state also provide that there shall be no undue delays in public utility undertakings. The land in dispute is a section to be flooded after the construction of the dam in connection with the four-million-dollar project.

North Central N.E.L.A. to Hold Convention on Lake Superior. — The seventh annual convention of the North Central Geographic Division of the N.E.L.A., comprising Minnesota, North and South Dakota, will be held early in the summer on Lake Superior. The steamship *Harmonic* will leave Duluth on Friday evening, June 24, and reach Port Arthur, Ontario, Saturday morning, sailing again in the afternoon for Sault Ste. Marie, which will be reached Sunday morning. From the Sault the steamship *Noronic* will take the delegates back to Port Arthur, whence they will finally sail Monday evening, reaching Duluth the following morning. Prominent men will address the electrical men en route and there will be round-table discussions as well as business and entertainment programs.

Building "White Way" up Lookout Mountain.—Work is proceeding rapidly on a "white way" up Lookout Mountain at Chattanooga, Tenn., half of the poles being set, and it is hoped to turn on the light on June 12, when a new road up the mountain is to be dedicated and the cornerstone laid for a hotel on the hilltop that will replace the famous Lookout Mountain House, burned many years ago.

Sultan River Development and City of Everett, Wash.—Informal agreement between the city of Everett, Wash, which takes its water from the Sultan River, and Joseph Wickstrom of Gold Bar, head of a proposed three-million-dollar power development on that stream, has been announced. The city objected to the development on the ground that the supply of water for the city in the future might be reduced. The Wickstrom project consists of a dam 275 ft. high and a power plant to develop 50,000 hp. Mr. Wickstrom declares the project is completely financed and that construction will start as soon as minor objections have been removed. He is president of the Startup Water & Power Company, which develops 2,000 hp.

Florida House Turns Down State Regulation Measure.—The bill introduced in the House of Representatives at Tallahassee, Fla., several weeks ago which provided for placing all electric power plants and transmission lines within or partly within the state under the jurisdiction and control of the State Railroad Commission has been disapproved by the House.

Danville, Va., to Vote Again on Selling City Plant.—Voters of Danville, Va., will go again to the polls on June 10 in a referendum on selling the city-owned electric light and power and gas plants for $2,750,000. Last December the people voted by a majority of 251 against selling the plants. Since then a group of men have revived the issue, holding that there is a change in sentiment, and the City Council has adopted a resolution promising to accept terms no less than those offered before and agreeing to devote the purchase price to retiring the municipal debt, which is nearly $3,000,000. While the Council is not required to sell to the Appalachian Power Company, the previous bidder, it is understood that that company is ready to resume negotiations.

Nebraska Company Offers to Take Energy Output of Government Dam at Guernsey, Wyo.—S. P. McFadden, representing the Western Public Service Company, which serves a number of cities in the North Platte Valley of Nebraska, has made a proposal to the business interests of that section to purchase all of the electrical energy developed at the government dam and power plant at Guernsey, Wyo. These interests secured the passage at the last session of the Legislature of a law that will permit municipalities and other units to bond themselves to build distribution systems and buy energy at wholesale from the power project. Mr. McFadden says that his company is prepared to purchase all existing transmission lines of the government if it desires to sell them, will carry out all existing contracts and make further contracts. The proposal is also to be submitted to the governing boards of three irrigation districts which have been figuring on making use of the powers bestowed by the new law.

Power Development in North Carolina.—The Carolina Power & Light Company is spending $27,000,000 in North Carolina this year in power development, P. A. Tillery, vice-president and general manager of the company, declared last week in speaking to a gathering of Raleigh citizens. While a considerable proportion of the Carolina company's new development is in the Piedmont and western half of the state, Mr. Tillery said, its principal activities are in the eastern section and long transmission lines will carry the power wherever there is a demand. The company is now constructing an 85,000-hp. development on the Yadkin

Coming Meetings of Electrical and Allied Societies

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

American Association of Engineers—Tulsa, Okla., June 6-8. M. E. McIver, 63 East Adams St., Chicago.

Association of Iron and Steel Electrical Engineers—Exposition, Syria Mosque, Pittsburgh, June 13-18. J. F. Kelly, Empire Building, Pittsburgh.

Pacific Coast Electrical Association—Santa Cruz, Cal., June 14-18. S. H. Taylor, 447 Sutter St., San Francisco.

Electrical Safety Conference — 109 Leonard St., New York, June 15. R. R. Shepard, 109 Leonard St., New York.

National Electrical Credit Association—Cleveland Hotel, Cleveland, June 16-17. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Institute of Electrical Engineers—Summer convention, Detroit, June 20-24. F. L. Hutchinson, 36 West 39th St., New York.

American Society for Testing Materials — French Lick, Ind., June 20-24. C. L. Warwick, 1315 Spruce St., Philadelphia.

Empire State Gas and Electric Association, Commercial Section—Elmira, N. Y., June 21-22. C. H. B. Chapin, Grand Central Terminal, New York.

Northwest Electric Light and Power Association—Salt Lake City, June 21-24. C. W. Lundquist, Utah Power & Light Co., Salt Lake City.

American Society of Agricultural Engineers—University Farm, St. Paul, Minn., June 22-25. Raymond Olney, St. Joseph, Mich.

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 24-28. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Michigan Electric Light Association—Grand Hotel, Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

East Central Division, N.E.L.A. — Cedar Point, Ohio., July 12-15. D. L. Gaskill, Greenville, Ohio.

River, near Norwood, and a 90,000-hp. development on the Pigeon River, near the Tennessee line. In August a connection will be made with the Appalachian Power Company at Danville, Va., and at Kingsport, Tenn., with the result that interconnected transmission lines will stretch unbrokenly from the Great Lakes to Muscle Shoals.

South Carolina Power Opens New Offices at Charleston.—The South Carolina Power Company has opened new offices at King and Wentworth Streets, Charleston, S. C. Large crowds attended the opening on the evening of May 24. The building is marked with the largest electric sign in Charleston, burning 648 ten-watt lamps, and the windows are lighted with reflectors and spotlights which permit the use of colors.

California-Oregon Power Company Doubles Capacity of New Rogue River Plant.—Announcement is made by H. M. Byllesby & Company that the California-Oregon Power Company will double the capacity of its Prospect No. 2 hydro-electric plant, now under construction on the North Fork of the Rogue River in Oregon, by the early installation of a second 15,000-kw. unit. Work on the construction of this plant was started early in the year, and the first 15,000-kw. unit is expected to be ready for operation by Oct. 1. Installation of the second unit involves enlargement of the power house and installation of an additional wood-stave pipe line and penstock, but no addition to the diversion dam or canal will be necessary, as these are being constructed of ample size to provide for the ultimate capacity of 45,000 kw. A high-tension transmission line will be built to connect the new plant with the company's transmission system at Medford, Ore., and in connection with the installation of the second unit this line will be extended to connect with Copco Nos. 1 and 2 hydro-electric plants.

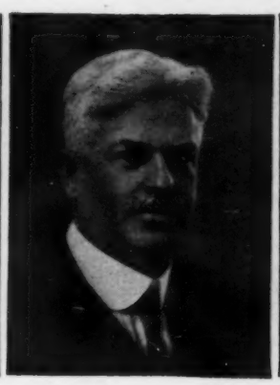
National Electrical Credit Association Meets Next Month in Cleveland.—The twenty-ninth annual meeting of the National Electrical Credit Association will be held at the Hotel Cleveland, Cleveland, on Thursday and Friday, June 16 and 17. On Thursday morning W. E. Rice of the Graybar Electric Company, the chairman of the program committee, and Harold E. Wilkins, national president of the association, will speak, and Mayor Marshall will welcome the delegates. After this there will be consideration and action on resolutions presented by the chairman of the "functional plan" committees. Harry L. Grant of the Graybar Electric Company will speak on distribution. Leonard P. Ayres, vice-president Cleveland Trust Company, will address the meeting on the trend of business. On Friday there will be six-minute talks by the presidents of the five divisions of the association—New England, New York, Middle and South Atlantic, Central, and Pacific Coast. Other speakers will be J. C. Fisher, Jack North and O. J. Condon. The annual dinner will be on Thursday evening, Secretary Frederic P. Vose acting as toastmaster.

Men of the Industry

New Vice-Presidents of the General Electric Company

The election of three new vice-presidents and the retirement of two executives of the General Electric Company were announced in last week's issue of the ELECTRICAL WORLD. Closely following this news came the announcement by E. W. Allen, vice-president of engineering, that **W. S. Moody**, in general charge of the transformer engineering department of the company since its inception, has been appointed a consulting engineer for all transformer departments of the company and for all departments of the Pittsfield works, and that **F. W. Peek, Jr.**, who has been a consulting engineer in the transformer department and in charge of the high-voltage testing laboratory, has been named engineer of the general transformer department to succeed Mr. Moody.

C. C. CHESNEY



C. E. EVELETH

W. R. BURROWS

Cummings C. Chesney, the new vice-president, who will act as chairman of the manufacturing committee, has been identified with the General Electric Company and its predecessors since 1888, when he joined William Stanley's laboratory force at Great Barrington, Mass., devoting himself particularly to experimental chemistry and electrodynamics. The following year he went with the United States Electric Lighting Company in Newark, N. J., a subsidiary of the Westinghouse Electric & Manufacturing Company. In 1890 he moved to Pittsfield, Mass., where he was one of the original incorporators of the Stanley Electric Manufacturing Company. Mr. Chesney was vice-president and chief engineer from 1904 to 1906. On the latter date he took up the duties of chief engineer and manager of the Pittsfield works of the General Electric Company, which company had acquired the Stanley Electric Manufacturing Company. He has since held the position as manager of the Pittsfield works of the General Electric Company. Mr. Chesney has been a tireless worker and has made a point of keeping in close contact with all phases of his organization. Many of the industry's highest honors have fallen to him. In February, 1922, he was awarded the Edison medal for 1921 and a diploma in recognition of his contribution toward the perfecting of alternating-current machinery and high-power transmission. He is president of the American Institute of Electrical Engineers and will serve as a member of its board of directors during the next administrative year, beginning Aug. 1.

Charles E. Eveleth, another new vice-president, is also a veteran in the service of the General Electric Company. He started as foreman of the testing department in 1899, one year later becoming research and experimental engineer in the switchboard department. From 1903 to 1917, Mr. Eveleth was affiliated with the railway department. After a period of service as executive engineer in the turbine department at Schenectady and subsequently at Lynn, he returned to Schenectady as assistant works manager, one year later being promoted to be works manager. Mr. Eveleth has been active in association work, being a member of the A. I. E. E. and having contributed miscellaneous papers to the proceedings of the representative engineering societies.

The third new vice-president is **W. R. Burrows.** Mr. Burrows was formerly associate manager of the incandescent-lamp department. In his new office he will be associated with Mr. Chesney in the administration of the manufacturing department.

George C. Ward, vice-president of the Southern California Edison Company, was awarded the honorary degree of doctor of engineering by the University of Southern California at the annual commencement exercises held June 4 at the Los Angeles Coliseum in Exposition Park. Mr. Ward's achievements as a hydro-electric engineer and public utility executive have been outstanding.

Owen D. Young, chairman of the board of the General Electric Company, will be the chairman of the American delegation to the Stockholm meeting

of the International Chamber of Commerce, June 27 to July 2. The American delegation will be made up of more than 150 leading business executives, representing different lines of industry, finance and commerce. The delegates will sail on the steamship *George Washington* at midnight on June 14, arriving at Bremerhaven the morning of June 24, whence they will go direct to Stockholm by special train via Hamburg.

S. C. Pohe Leaves Light and Power Industry

Stephen C. Pohe, who resigned as vice-president of the Penn Public Service Corporation to join the Penn Petroleum Company, as already announced in the ELECTRICAL WORLD, has been closely identified with the growth of the Penn Public System throughout its history. His entry into the electrical

S. C. POHE

industry dates back to 1904, when he was appointed assistant to the general manager of the Berwick Electric Lighting Company of Pennsylvania. Two years later he was promoted to the position of manager. When the public utility properties of Berwick, Bloomsburg and Danville merged to form the Columbia Power, Light & Street Railway Company in 1909, Mr. Pohe was made business manager, in 1911 becoming general manager. In 1913 the H. D. Walbridge Company obtained a controlling interest in the Columbia company, but Mr. Pohe retained the general managership. Later these properties were sold by the Walbridge interests and Mr. Pohe remained under the new control until 1918, when he resigned to take charge of the Walbridge interests in Center, Clearfield and Indiana counties.

The Penn Public Service Corporation was formed in 1919 from the merger of these Walbridge properties with others in western Pennsylvania, and Mr. Pohe was elected vice-president in charge of the transmission and distribution system. Upon the acquisition of the company by the Associated Gas & Electric Company Mr. Pohe continued as vice-president and was placed in charge of operating, generating, wiring and the commercial offices in the central region. He has been a central figure in Pennsylvania electric circles, having held many executive offices in the Pennsylvania Electric Association, including the presidency. He has served on N.E.L.A. committees and is a member of the A.I.E.E.

Walter Whetstone of Philadelphia has been elected president of the Southern Cities Utilities Company, the holding company for the Southern Cities Power Company.

T. P. Gaylord, acting vice-president of the Westinghouse Electric & Manufacturing Company, has been elected president of the Pittsburgh Chamber of Commerce by the board of directors of that organization.

Augustus C. Smith, who has been connected with the Buffalo General Electric Company for 20 years, has been promoted to the position of general sales manager. For several years he has been sales engineer, handling the sale of power to large industries and next in authority to F. A. Coupal. In his new position he will retain all of his old duties as well as taking over Mr. Coupal's duties.

Robert H. Knowlton, formerly assistant to the vice-president of the United Gas Improvement Company in charge of operations, has been elected vice-president of the Connecticut Light & Power Company, Waterbury, Conn. A graduate of Cornell University, Mr. Knowlton has been engaged in public utility work since leaving college, joining the United Gas Improvement Company, Philadelphia, in 1910.

Marshall T. Jones, formerly acting chief of the electrical equipment division of the Department of Commerce, has been promoted to be chief of that division, according to an announcement made by O. P. Hopkins, acting director of the Bureau of Foreign and Domestic Commerce. Mr. Jones was born in Washington, D. C., and was educated at the public schools in Montclair, N. J., and at the engineering department of Cornell University. He has had considerable engineering experience both in this country and in foreign fields, in more recent years concentrating on electrical materials and equipment.

Thorne A. Browne, recently named as managing director for the Nebraska Section of the National Electric Light Association, has been appointed to the same position with the Midwest Geographic Division. Recommendation for the creation of the office was made by President F. H. Brooks, who believes the industry needs to present the facts in any controversy with the public. Mr. Browne, who is a veteran newspaper man, was a state railway commissioner for seven years. He will have his headquarters in Lincoln and will also act as secretary for the Midwest Division.

T. C. Ruhling left his position as superintendent of underground construction with the Kansas City Power & Light Company June 1 to enter the sales field. He is now in the organization of the Charles L. Ward Company in the Dallas (Tex.) office. Mr. Ruhling will handle the products of Schweitzer & Conrad, G. and W. Electric Specialty Company, Electric Service Supplies Company and Franklin Porcelain Company.

F. D. Mahoney New Vice-President of West Penn Power Company

F. D. Mahoney, who was elected vice-president of the West Penn Power Company, as announced in the May 28 issue of the ELECTRICAL WORLD, obtained his engineering training at the University of Wisconsin, joining the forces of the American Gas Company of Philadelphia upon graduation, as a junior engineer. Later, as assistant electrical engineer, his work took him to a number of states, including Wisconsin, Illinois, Iowa, Pennsylvania, New York and Vermont. During the war Mr. Mahoney served first as a consulting engineer in the Ordnance Department and later as assistant to the director of construction of the United States nitrate plants at Muscle Shoals, Ala., and Toledo and Cincinnati, Ohio.

Following the war Mr. Mahoney joined the operating forces of the Ala-

F. D. MAHONEY

bama Power Company, Birmingham, as commercial manager, taking a similar position with the West Penn Power Company in July, 1922.

Julian C. Smith, vice-president of the Shawinigan Water & Power Company, Ltd., has been made a director of the Canadian General Electric Company, Ltd.

R. B. Keating has been elected vice-president in charge of finances of the West Penn Electric Company and will have financial supervision over all of its operating properties. Mr. Keating has for the past thirteen years been prominently connected in various financial capacities with the West Penn Electric properties and formerly had had a wide public utility experience.

Horace L. Mann, treasurer of the Buffalo, Niagara & Eastern Power Corporation for the past two years, has been elected vice-president of the company in charge of its finances. Mr. Mann has been treasurer of the Buffalo, Niagara & Eastern Power Corporation since it was organized in 1925 and for seventeen years was treasurer of the Buffalo General Electric Company. His entire business career has been in the field of accounting and finance.

Samuel E. Doane, chief engineer of the National Lamp Works of the General Electric Company, Nela Park, Cleveland, has been awarded the honorary degree of electrical engineer by the Case School of Applied Science.

Mr. Doane was associated with the early activities of Thomas A. Edison and has been a figure in the electrical industry since 1886. For more than 40 years he has been connected with the lamp industry and has seen it grow from small beginnings and crude devices to the large organizations and elaborate lighting systems of today. In the early days of the industry he proposed the organization of a laboratory to study and perfect the incandescent lamp and its applications, and it is through the work of this laboratory that much of the progress of later years has been made. Mr. Doane has also been deeply interested in the study of illumination in the engineering colleges and has trained many of their graduates for services as illuminating engineers.

C. A. Clendening, chairman of the Manitoba (Canada) Hydro-Electric Power Commission, has resigned. Mr. Clendening had served as chairman of the commission for the past four years.

J. E. Couch has resigned as manager of the Arkansas Power & Light Company at Arkadelphia and Malvern to join the Dallas Power & Light Company. Mr. Couch is returning to Dallas, his home for 20 years before removing to Arkadelphia, where he has been connected with the Arkansas Power & Light Company for the past four years.

Walter E. Thau, manager of marine engineering in the general engineering department of the Westinghouse Electric & Manufacturing Company, has been appointed director of marine engineering, according to an announcement made by W. S. Rugg, vice-president of the Westinghouse company. Mr. Thau entered upon his new duties June 1, with headquarters in New York City. Mr. Thau, who is well known throughout marine and electrical circles because of his pioneering work in connection with the Diesel-electric propulsion of ships, will in his new work co-ordinate all of the Westinghouse company's engineering affecting the marine field and maintain engineering contact and service to the marine industry as a whole.

Obituary

William R. Jacobus, superintendent of the Water and Electric Department of the Borough of Groton, Conn., died last week of injuries received when an air compressor exploded. Mr. Jacobus was born in Newark, N. J., in 1886 and entered the employ of the Brooklyn Edison Company in 1906, at the same time studying at Pratt Institute, from which he was graduated in 1910.

Henry E. Huntington, railroad magnate and an officer and director in numerous public utility and industrial organizations, died in Philadelphia May 23 in his seventy-seventh year. Mr. Huntington was known especially for his work in the transportation field both in the steam railroad branch and the electric railway branch. His activity as a financier and community builder and developer was partly obscured during the last ten years of his life by his generous donations to the world of science and art and by the intense interest he took in those branches of human activity. At the time of his death he was president of the Los Angeles Railway Corporation, the Los Angeles Railway Land Company and the Huntington Land & Improvement Company and chairman of the board of directors of the Safety Insulated Wire & Cable Company, New York, and the Newport News Shipbuilding & Dry Dock Company. He also served on the directorate of the Southern California Edison Company, the Newport News Light & Water Company and various other companies.

Recent Court Decisions

Erector of High-Voltage Wires Cannot Disclaim Duty in Case Where Adjacent Wires Are Erected Later by Others.—One Speich, a wireman employed by the General Electric Company of Buffalo, was instructed to climb a pole used jointly by his employer and the New York Telephone Company. Placing his hand on a climbing spike, he received an electric shock from a feed wire of the International Railway Company from which the insulation had worn off at a point where it touched the spike, the shock causing him to fall to the ground and suffer serious injury. Sued by Speich, the railway company disclaimed responsibility on the ground that its wire was already in existence when the telephone company erected the joint-use pole and that therefore the insuring of safe conditions devolved upon the latter. A nonsuit was granted by the trial court, but the Appellate Division of the Supreme Court of New York has ordered a new trial on the ground that the railway company was bound to exercise all due care even in conditions arising subsequently to the original erection of its line, that negligence by others did not absolve it, and that the railway's alleged negligence should have been submitted to the jury. (221 N. Y. S. 66.)*

Jury's Finding on Contributory Negligence Conclusive.—In Perkins vs. El Paso Electric Company the Court of Civil Appeals of Texas declared the jury's finding that an electrical engineer killed by an escaping charge of electricity was not guilty of contributory negligence was based on a finding of fact and that the contention that he was quilty of negligence as a matter of law could not be sustained. A verdict for $30,000 damages was held not to be excessive. In this case the man killed was shown to have made every test to assure himself that the line on which he was to ground a wire was dead, but he did not use a rope in passing a chain over the wire, nor did he heed a warning that the discharge from a ground pipe on another part of the line was unusually heavy. These omissions, the court held, did not break the causal connection between his death and the negligent closing of a switch while the victim was going on with his work. Evidence was that be went directly from his tests to put the chain across the line and had no reason to fear that it would be energized a few minutes later in the way it was. (292 S. W. 935.)

Use of Public Highways.—The Illinois Supreme Court has declared, in Illinois Power Company vs. Wieland, that, in the construction of a rural electric transmission line on a highway, to entitle abutting property owners to compensation for damages to land not taken they must show some direct physical disturbance of a right which they enjoy in connection with their property and which gives it additional value; that while injuries necessarily and actually inflicted on trees may be included in the amount of damages, a jury cannot award damages which are merely speculative and remotely contingent, and that the unsightliness of poles carrying electric wires is not a proper element of damages, especially where there is no evidence that they would be unsightly. (155 N. E. 272.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Extensions Beyond Chartered Territory Forbidden. — Electric light and power companies in Pennsylvania cannot, according to the Public Service Commission of that state, in adjudicating a case affecting the Plain Grove Township Lawrence Power Company, make extensions in order to meet public necessity and convenience in communities outside of their present chartered territories. Under the law companies desiring to make extensions in townships not included in their charters must make application for additional charters. The law provides that charters for electric service may be granted for no greater territory than is comprised within the limits of individual townships or parts thereof. Under the law the chartered companies may be, and in actual practice commonly are, merged with the parent companies.

Maximum Rates and Cost of Service. —Dismissing a case brought by the James A. Gunn, Jr., and Lake County Water & Power Company against the Pacific Gas & Electric Company, which, it found, owned a majority of the stock of the California Telephone & Light Company but did not operate it, and thereby confining to the California Telephone & Light alone a complaint of excessive rates made by the Gunn company, the California Railroad Commission declared that an electric company buying energy from another company cannot require the seller to establish a maximum rate which shall be the rate at which the seller purchases the energy from a third company, since the seller, in order to ascertain the cost of the energy sold, must make allowances for loss in transmission, operating expenses, depreciation and return.

Financial and Statistical

Advance in Common Stocks
Position Essentially Sound
Bond Market Quiet

COMMON stocks of the power and light companies have made a further advance, along with the industrial and rail groups, during the week. The utility stock index compiled by the ELECTRICAL WORLD is now approximately 20 points higher than at this date last year. Public Service of New Jersey led the week's advance. Gains were made also by American Gas & Electric, Columbia Gas & Electric, Detroit Edison and Southeastern Power & Light.

These advances notwithstanding, the broad list of utility stocks has not moved in correspondence with the sharp upward trend in some of the other market groups. The fact that utility stocks have moved more conservatively emphasizes their favorable present position. Pool activities in several of the industrials have resulted in a buoyancy considered by many of the more conservative traders to be artificial. A comparison of the earnings position of representative power and light stocks with typical industrials, especially those which have figured in the recent rise, is decidedly favorable to the former. The conservative policy adopted by many of these companies makes the issues at present uninflated prices decidedly attractive.

Activity in preferred stocks and in bonds has been limited. Demand for high-grade utility bonds continues firm, but price changes during the past few weeks have been few.

Recent Listings.—First mortgage 6 per cent sinking-fund gold bonds, series A, of the Duke-Price Power Company, Ltd., have been authorized for listing by the New York Stock Exchange to the amount of $37,000,000. The New York Stock Exchange has also authorized the listing of an additional 119,820 shares of 6 per cent cumulative preferred stock of the Public Service Corporation of New Jersey on official notice of issuance and payment in full, making the total amount applied for 237,823 shares. The listing of 35,934 additional shares of common stock without par value of the American Power & Light Company on the New York Stock Exchange has been authorized by that body. This latest authorization makes the total amount applied for 1,945,321 shares.

March Revenue Gain Exceeds February's

Returns Show Increase of 9.6 Per Cent Over March, 1926—Energy Output, 6,289,369,000 Kw.-Hr.

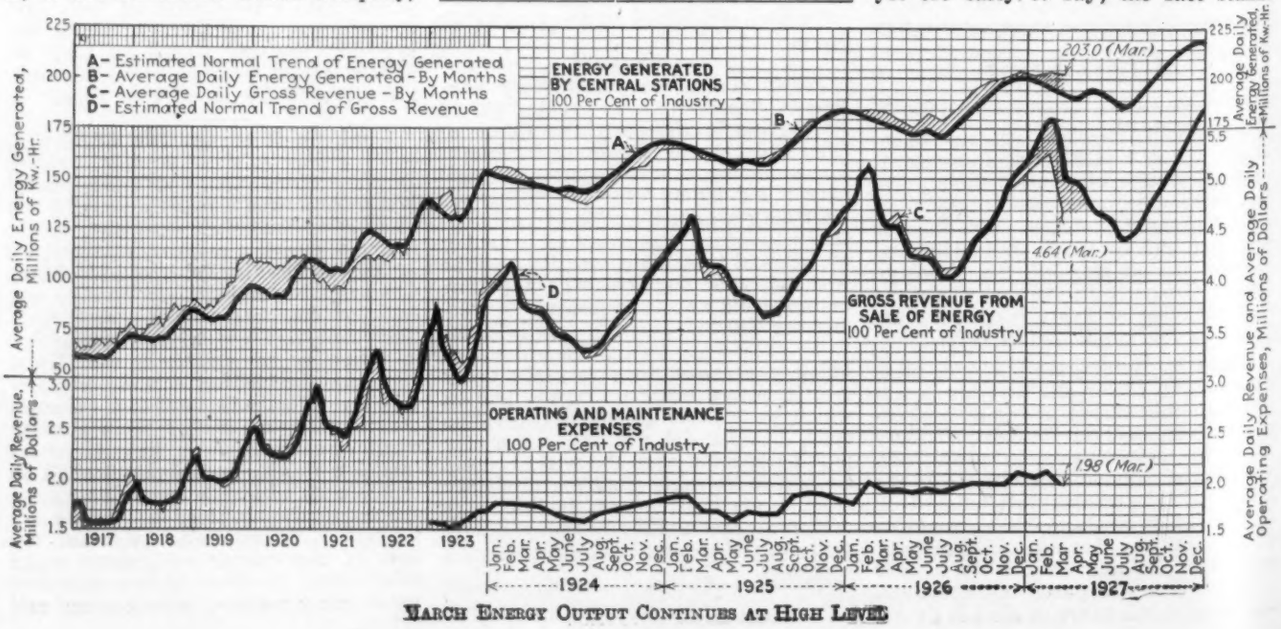
ACCORDING to monthly reports received by the ELECTRICAL WORLD, the revenue of the electric light and power industry in the United States for March, 1927, amounted to $143,800,000. The average gain for the country as a whole was 9.6 per cent over March, 1926. Viewed in connection with the 10.6 per cent increase for January and the 9.1 per cent increase for February, this indicates that the activity for the early part of 1926, which at that time was considered remarkable, is being repeated on a new high level, nearly 10 per cent above that of the previous year. Compared with February, 1927, the returns indicate a drop of 2.6 per cent in revenue, which is entirely in line with the seasonal trend and is, in fact, a slightly smaller decrease than occurred in the corresponding month last year. The amount of energy generated in March indicates that April will show a similar gain.

Statistics on energy output tell substantially the same story. The rate of increase for several months has been in the neighborhood of 10 per cent as compared with corresponding figures for the year preceding. During the early part of the year this rapid progress showed some signs of moderating; it now seems to have settled down to a slightly slower pace, but is still very close to 10 per cent.

With reference to the source of the energy generated, a rather striking shift has lately been noticeable. For a number of years the portion obtained from water power has averaged fairly close to one-third of the total. However, in December and January it had risen to about 37 per cent; in February it was 38 per cent and in March over 40 per cent. Whether this indicates a permanent change of balance or is due merely to temporary conditions, it is as yet too early to say; the fact stands

TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1926	1925	1926	1925	1926	1925
Dec.	43.4	45.5	36.7	35.5	40.8	42.6
	1927	1926	1927	1926	1927	1926
Jan.	40.6	40.6	33.3	31.8	39.2	40.4
Feb.	42.7	42.2	37.4	36.5	39.6	40.8
Mar.	45.2	44.9	37.9	36.1	42.4	44.2


A- Estimated Normal Trend of Energy Generated
B- Average Daily Energy Generated - By Months
C- Average Daily Gross Revenue - By Months
D- Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
2030 (Mar.)
464 (Mar.)
198 (Mar.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

MARCH ENERGY OUTPUT CONTINUES AT HIGH LEVEL

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
December.	6,375,500	5,714,067	+11.6	5,195,500	4,611,067	1,400,000	1,258,000	3,195,500	2,803,067	600,000	550,000	1,180,000	1,103,000	1,261,000	900,000
	1927	1926		1927	1926	1927	1926	1927	1926	1927	1926	1927	1926	1927	1926
January...	6,303,199	5,683,055	+10.9	5,183,199	4,586,055	1,450,000	1,260,000	3,110,199	2,771,055	623,000	555,000	1,120,000	1,097,000	1,209,000	965,000
February..	5,707,521	5,190,645	+ 9.9	4,687,521	4,188,645	1,325,000	1,128,000	2,804,521	2,559,645	558,000	501,000	1,020,000	1,002,000	1,138,000	919,000
March.....	6,289,369	5,727,028	+ 9.8	5,174,369	4,621,028	1,260,000	1,212,000	3,329,369	2,854,028	585,000	555,000	1,115,000	1,106,000	1,275,000	1,085,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on nergy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

out, though, that the energy generated from water power for March, 1927, exceeded that for any previous month in the history of the industry. Meanwhile, the output from fuel continues to increase, as compared with last year, but with a steady improvement in the efficiency of fuel use.

Regionally, the greatest gains in energy output have occurred in the South Atlantic States, 17 per cent, and in the West South Central States, 26 per cent. The gains in the Middle Atlantic, East North Central and East South Central States have been close to the national average; in New England and in the Far West progress in March was slower.

Subject to slight revision in the light of belated returns, a comparison of revenue reports for February and March indicates that business in the South Central and New England States was a little below that of the country as a whole, while in the Far West it was about 2.5 per cent higher than the national average. In all these sections, however, there was a perceptible gain compared with 1926. This was at the expense of the Atlantic States, which nevertheless are still slightly above the national average. Sales of energy for resale continue to increase and were about 17 per cent in excess of March, 1926, being estimated, on the basis of returns in hand, at 1,275,000,000 kw.-hr.

Reproduction Cost as Rate Base Alleged to Be Unsound*

Massachusetts Utility Commissioner Defends New England Viewpoint on Property Valuation—Prudent Investment Theory Favored on Economic Grounds

BY LEWIS GOLDBERG
Member Massachusetts Department of Public Utilities

GENERALLY understood, the reproduction theory is this: That, in determining what the base rate for a utility should be, you ought to undertake to determine the value of the plant on a reproduction basis, with costs of labor and materials projected into the reasonable future, minus observed depreciation; guess whether the plateau of prices will remain more or less on a level or whether they will go up or down, take into consideration the original cost and the historical cost, add assumed costs of organization, engineering and supervision, add theoretical costs of financing and interest during construction and take into consideration such other factors as may seem to be pertinent.

*From an address delivered by Commissioner Goldberg before Electrical Association of Boston.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
December.	$154,700	$137,400	+12.6	$95,200	$89,700	$43,500	$34,400	$5,400	$4,600	$10,600	$8,700	$63,200	$57,800
	1927	1926		1927	1926	1927	1926	1927	1926	1927	1926	1927	1926
January...	160,500	145,100	+10.6	101,300	92,300	42,700	38,300	5,600	5,300	10,900	9,100	61,800	55,900
February..	147,600	135,300	+ 9.1	92,900	84,000	39,000	37,300	5,200	4,800	10,500	9,200	59,700	54,000
March.....	143,800	131,200	+ 9.6	83,900	80,000	43,800	37,100	5,100	4,800	11,000	9,300	61,200	55,900

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Short Tons	1925 Short Tons	Per Cent Increase	1926 Barrels	1925 Barrels	Per Cent Increase	1926 Thousands of Cubic Feet	1925 Thousands of Cubic Feet	Per Cent Increase
December.....	2,377,175	1,946,949	+22.1	3,998,225	3,767,118	+6.1	3,406,140	3,350,689	+1.6	769,518	761,140	+ 1.1	3,685,611	3,671,437	+ .4
	1927	1926		1927	1926		1927	1926		1927	1926		1927	1926	
January.....	2,331,140	1,928,775	+20.9	3,972,059	3,754,280	+5.8	3,365,461	3,272,761	+2.8	786,062	972,131	—19.1	3,900,868	3,661,363	+ 6.1
February.....	2,173,313	1,886,471	+15.2	3,534,208	3,304,174	+7.0	2,959,140	2,886,534	+2.5	646,656	683,580	— 5.4	3,855,469	3,328,365	+15.8
March.....	2,528,288	2,237,457	+13.0	3,761,081	3,489,571	+7.8	3,090,131	3,071,092	+ .6	613,558	670,248	— 8.4	4,312,530	3,899,085	+10.6

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Now, as business men, if some one told you that the value of your respective plants was based on any such scheme as that, you would laugh them to scorn. The fact is that when plants are sold the managers and owners of the utility selling out do not give the slightest thought to what the reproduction cost would be; nor do the managers or owners of the combination buying the utility give any thought to what the reproduction value would be. It may be that, from an economic viewpoint, that is a fair test as to whether the reproduction theory has any value.

You look at your book assets, you inspect your earning sheet, you examine your operating expenses, you want to know how depreciation has been taken care of, and you look at the plant as it is and not at some fanciful theoretical plant which might be reproduced in exactly the same manner as this plant now exists. I say it is unsound because it is not businesslike from that point of view, and further because it is not true to fact, because never in this business world would any plant be reproduced as it is if you were going to build it from the ground up. To say that would involve the supposition that since the inception—or, rather, since the formation—of your business, since the beginning of the construction of your individual plant, there has been no improvement in the art of that utility. It would be rather a bad confession for any utility, and furthermore it would not be true. Let us take the electric utility, for example. Is there any electric plant existing anywhere in this commonwealth today that would be produced stone for stone, foundation for foundation, building for building, generator for generator, transformer for transformer, just as that plant exists today? Why, of course, everybody knows it would not, and so your theory calls for the reproduction of something which would never be reproduced and involves taking into consideration the value of that which you would never buy today if you were rebuilding your plant.

THEORY IS INCONSISTENT

And the reproduction theory, recognizing that there are certain things that cannot be reproduced, is inconsistent with itself. It does not attempt to reproduce land, but it says we will take land at its present market value and not project it into the future as you do when you build your plant; not project it over a period of eighteen months or fourteen months, whatever the period required for building a plant is, but your present market value, and we will take the prices of labor and materials and project them over this 24-month period needed for construction. Where is the consistency of taking one item on one basis and taking the plant on another basis? If a person is going to be inconsistent, he ought to be consistently inconsistent.

There is still one other inconsistency in the theory. They not only take the land at present market prices, they not only take the plant at a reproduction price projected into the future and attempt to calculate the labor and materials that go into that plant, and what the probable cost of that material will be over the period necessary for construction, and what the probable tendency of labor prices will be over that period; but with respect to certain of the assets they will determine a substitute for them, capitalize the cost of creating and operating this imaginary substitute for that particular part of the plant and add this capitalized figure to the reproduction value. They say it would cost so much money to construct the substitute, the cost of operating it would be so much, and capitalizing this cost of operation and adding to it the cost of constructing the

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday May 31	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	97½	83	97½
Adirondack Pwr. & Lt.—7% pf.	110½	107	110½
Adirondack Pwr. & Lt.—8% pf.	115	112	115
Ala. Pwr., $7 cum. pf.—no par	113½	107	112½
Allis-Chalmers Mfg., 7% pf.	111½	109	112½
Allis-Chalmers Mfg., 6% com.	111½	88	111½
Aluminum Co. of Amer., com.	68	67½	73
Aluminum Co. of Amer., 6% of.	103½	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	*m*110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	100	86½	100
Amer. & Foreign Pwr., com.—no par.	24½	18½	25½
Amer. Bosch Magneto, com.—no par	14	13	18½
Amer. Brown Boveri Elec†.	22½	20½	39½
Amer. Brown Boveri Elec., pf. $7.	*k* 82	84½	98
Amer. Gas & Elec., 6% pf.—no par.	105½	95½	105½
Amer. Gas & Elec., com.†—no par.	89½	68½	100½
Amer. Lt. & Trac., 6% pf.	114	112	120
Amer. Lt. & Trac., com.†	249	222	262
Amer. Pwr. & Lt., 6% pf.	106½	97½	106½
Amer. Pwr. & Lt., com.†—no par.	62½	54	64½
Amer. Pub. Serv., 7% pf.	*k*101	95	99½
Amer. Pub. Serv., com.†	65	....	....
Amer. Pub. Utilities, 7% ptc. pf	87½	73	88
Amer. Pub. Utilities, 7% pr. pf.	92½	88	93
Amer. Pub. Utilities, com.	57	65	70
Amer. States Sec., A.	2½	2½	4½
Amer. States Sec., B.	2½	2½	4½
Amer. Superpwr., 6% ptc. pf.—25.	28½	26½	29
Amer. Superpwr., 6% 1st pf.	*k* 96	....	....
Amer. Superpwr., Class A†—no par.	37½	27½	37½
Amer. Superpwr., Class B†—no par.	38½	28½	38½
Amer. Wtr. Wks. & Elec., 7% pf.	*k*108½	104½	110½
Amer. W. W. & E., com. $1.60—20.	85½	62½	85½
Anaconda Copper 2d $3	46½	45	49½
Appalachian Electric Pwr., 7% 2d pf.	100	100	104
Appalachian Elec. Pwr., 1st pf., 7%.	102	100	102
Appalachian Elec. Pwr., com.	*m*78	....	....
Arizona Pwr., 7% pf.	82	77	84½
Arizona Pwr., com.	22	....	....
Arkansas Pwr., & Lt. 7% pf.	103½	....	....
Assoc. Gas & Elec., $3.50—50.	52	....	....
Assoc. Gas & Elec., pf.—$6—no par.	92	85	93
Assoc. G. & E., Class A, 10—no par.	40½	35	42
BABCOCK & WILCOX, 7% com.	118	....	....
Binghamton L., H. & P., $6 pf.	96	93	98
Birmingham Elec., pf.—$7—no par.	108½	105	109
Blackstone Valley G. & E., 6% pf.	106	103	105
Blackstone Valley Gas & Elec., 10% com.—50.	137½	98	154½
Blaw-Knox, com.†	*k* 70	70	73
Brazilian Trac., Lt. & pwr., com.†	*f*154½	....	....
Broad River Pwr., 7% pf.	100	97	100
Brooklyn Edison, 8% com.	165	148½	169½
Buffalo, Niagara & East. Pwr., pf.—25	*k* 26	....	....
Buffalo, Niagara & East. Pwr. com.† —no par	*k* 31½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	98	96	98
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	*l*109	107	108½
Central & S.W. Util., $7 pf.—no par	*a* 97	93½	97½
Central & S. W. Util., pr. ln. $7 pf. —no par	*a*101	98½	103
Central Ariz. Lt. & Pwr., 8% pf.	*k* 97	95	98
Central Ark. Ry. & Lt., 7% pf.	103	100	104
Central Ill. Pub. Serv., $6 pf.	*k* 88	88	91
Central Ind. Pwr., 7% pf.	91	86	90
Central Pwr. & Lt., 7% pf.	*k*101	100½	103
Central States Elec., 7% pf.	95	93	96
Central States Elec., com.†	*m*200	....	....
Century Elec., 6% com.	*m*115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	*a* 33	30	34½
Cincinnati Gas & Elec., 5% com.	*g* 96½	96½	97½
Cities Service, 6% pf.	*l* 90½	88½	92½
Cities Service, pf. B—10	*l* 8	8	8½
Cities Service, pf. BB—100	*l* 82	80½	85
Cities Service, com.—20	*l* 46½	40½	58½
Cities Service, Bks. Shrs.—10.	*l* 22½	22½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110	108	110
Cleveland Elec. Illg., 10% com.	298	302	310
Columbia Gas & Elec., 6% pf.	107	99½	107½
Columbia G. & E. com. $2.60—no par.	98½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	*m* 94	....	....
Columbus Elec. & Pwr., 7% pf., A.	108	....	....
Columbus Elec. & Pwr., $2 com.—no par	64	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102½	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	102	96	103½
Columbus Ry., P. & L., com.—no par	80	75	79
Commonwealth Edison, 8% com.	*a*154	138	150½
Commonwealth Pwr., 6% pf.	99	91½	99½
Commonw'th Pwr., $2, com.—no par	51½	48	52
Conn. Lt. & Pwr., 8% pf.	120	119	123
Conn. Lt. & Pwr., 7% pf.	116	112	113½
Cons. Gas of N. Y., pf.†—50.	*k* 56½	55½	62½
Cons. Gas of N. Y., com $5—no par.	105½	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	*m*108½	106½	108½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	*e*111½	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	*e*114½	111	115
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	*e*128½	126	129
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	*e* 59	51	58½
Consolidated Pwr. & Lt., 7% pf.	101	100	103
Consumers Pwr., 6% pf.	102½	100	102
Consumers Pwr., 6.6% pf.	105½	103	105½
Continental Gas & Elec., 8% ptc. pf.	107½	103	106½
Continental Gas & Elec., 7% pr. pf.	103½	100	103
Conti. G. & E. com. $4.40—no par.	*k*215	210	225
Crocker Wheeler, com.†	31	....	....
Crocker Wheeler, 7% pf.	82	....	....
DALLAS PWR. & LT., 7% pf.	108	107	109½
Dayton Pwr. & Lt., 6% pf.	105	101	103
Detroit Edison, 8% com.	155½	133½	155½
Dubilier Condenser, com.—no par.	*k* 4½	3½	5½
Duquesne Lt., 7% pf.	116½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	103	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	87	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	*d*257	217	*f*259
El Paso Elec., 7% pf.	108	105	107½
Elec. Bond & Share, 6% pf.	*l*100	105½	109
Elec. Bd. & Sh. Sec., com. $1—no par	*l* 73	67½	76½
Electric Household Util.†	*a* 14½	11	15½
Elec. Investors, 6% pf.—no par.	93	92	94
Elec. Investors, com.†—no par.	37½	32½	40½
Elec. Investors, 10% pd. receipts.	*m* 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	104	96	104½
Elec. Pwr. & Lt., ctfs., 40% pd.	113	103½	115
Elec. Pwr. & Lt., ctfs. full pd.	*k*114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	22½	16½	23½
Elec. Refrig. cap.†	25½	22½	37½
Elec. Ry. Securities, com.—no par.	*m* 6½	....	....
Elec. St. Battery com. $5.25—no par	71	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	101	99	101½
Emerson Elec., pf.	*m*108½	108½	108½
Empire Pwr., ptc.†	34	....	....
Engr. Pub. Serv., $7 pf.—no par.	105½	93½	106½
Engr. Pub. Serv., com.—no par	28	21½	28½
Eureka Vacuum Cleaner, com. $4—no par.	71½	60½	73½
FAIRBANKS MORSE, 7% pf.	*k*112	107½	112
F.-M., com.—$3—no par.	41½	37½	43½
Federal Lt. & Trac., com. $1.40.	44½	37½	47
Federal Lt. & Trac., $6 pf.—no par.	98	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	*l*110½	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	74	68	72
Galveston-Houston Elec., com.	23	22	30
Gen. Elec., $3 com.—no par.	104½	81	104½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	42½	34	47½
Gen. G. & E. (Del.) com. B—no par.	43	35½	43½
Gen. G. & E. (Del.) pf. A. $8—no par.	*k*118	113½	118½
Gen. G. & E. (Del.) pf. A $7—no par.	*k*107	100	107½
Gen G. & E. (Del.) pf. B $7.	*k*102	96	104
Gen. Pub. Serv., $7 conv. pf., no par	*k*107½	102	106
Gen. Pub. Serv., com., no par.	15	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	92	87	92
Ga. Lt., Pwr., & Rys., com.	60	....	....
Ga. Ry. & Pwr., 8% pf.	123	119	123
Ga. Ry. & Pwr., 7% pf.	112½	106	110
Gt. Western Pwr., 7% pf.	*k*102½	....	....
IDAHO PWR., 7% pf.	106	103	105
Ill. No. Utilities, 6% pf.	*k* 88	88	92
Ill. Pwr. & Lt., 7% pf.	100½	99	101
Ingersoll Rand com. $8.	94½	89½	96½
Int. Combus. Engr., com. $2—no par ex. div.	48	43½	64
Int. Util., Class A—$3.50—no par.	35	28	36
Int. Utilities, Class B—no par.	7½	3	7½
Interstate Pwr., pf.—$7—no par.	*k*95½	93	98
Interstate Pub. Serv., 7% pf.	99½	98	99½
Iowa Ry. & Lt., 7% pf.	98*d*	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	101	97½	103
Johns-Manville, com.†—no par.	76½	55½	76½

Stock Exchange: *a*Chicago; *k*St. Louis; *e*Philadelphia; *d*Boston; *c*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 28. *l*Bid price Wednesday, June 1. *m*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday May 31	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k115¼	112	115¼
Kansas Gas & Elec., 7% pf.	l107	103	107
Kentucky Hydro-Elec., 7% pf.	a 95½	94½	97½
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	109½	110	115
Kentucky Utilities, 6% pf.	97	95	97
Keystone Pwr. & Lt., 7% pf.	98	96½	99
LACLEDE GAS LT., 12% com.	243½	173½	263
Lehigh Pwr. Sec., com.—no par.	18½	15	20
Long Island Ltg., 7% pf.	111⅛	107½	112
Long Island Ltg., com.†—no par	145	139	153
Los Angeles Gas & Elec., 6% pf.	99	98	100½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	28
MAN. ELEC. SUPPLY, cap. $5 —no par	68½	53½	72
Manila Elec., com.†—no par	k 43½	40	46
Maytag Mfg., com. .50—no par	30	23½	32½
Memphis P. & L., pf.—$7—no par	107	107	109
Metropolitan Ed., pf.—$6—no par.	k 98½	93	97
Metropolitan Ed., pf.—$7—no par.	107	104	108
Metropolitan Ed., com. $5—no par.	65	....	....
Middle West Utilities, 7% pf.	a110½	105½	113½
Middle West Util., 8% pr. lien	a120½	117½	122½
Middle West Util., com. $6—no par	a114	108	116½
Midland Utilities, pr. ln. 7% pf.	a105	98	104
Midland Utilities, 7% pf. A	a100	96½	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k100	98	101½
Minn. Pwr. & Lt., 7% pf.	l107½	104	107
Miss. Pwr. & Lt., $8 pf.	110	106	111
Miss. River Pwr., 6% pf.	101	94	97
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par	k106½	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par	104	98	105
Mohawk Hudson Pwr., com.—no par	24½	20½	27
Montana Pwr., 7% pf.	m121	118½	123
Montana Pwr., 5% com.	100½	81½	104½
Montreal Pwr., 7½% com.	f 85	....	....
Mountain States Pwr., 7% pf.	99½	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	105
National Carbon, 8% pf.	a137	130½	137½
National Elec. Pwr., A†	a 24½	23½	25½
National Elec. Pwr., 7% pf.	a 97	93½	97½
National Lt., Ht. & Pwr., com.	22	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	107	101	108½
National Pwr. & Lt., com.†—no par.	22½	19½	23½
National Pub. Serv., 7% pf.	97	93	99
National Pub. Serv., 7% pfe., pf.	113	108	115
National Pub. Serv., A com. $1.60— no par	21½	18½	22½
National Pub. Serv., B com.—no par	k 18½	14	20½
Nebraska Pwr., 7% pf.	l109	106	108½
Nevada-Calif. Elec., com.	m 29½	25	31
New Brunswick Pwr., 4% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	101	98½	101
New Eng. Pub. Serv., pf. $7	97	95	97
N. J. Pwr. & Lt., 6% pf.	96	92	94
New Orleans Pub. Serv.—7% pf.	104½	103	105
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	102	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	52½	50	52½
No. Amer., com.—no par	50	45½	50½
No. Amer. Edison, $6 pf.—no par.	101½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	k 98½	93	99½
Northeastern Pwr., com.	17½	14½	18½
No. Indiana Pub. Serv., 7% cum. pf.	104½	102	104
No. N. Y. Utilities, 7% pf.	105½	103	105½
No. Ohio Pwr., com.—no par.	11½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	90⅜	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 92½	84	94
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., (Del.) 7% pf.	106	100½	107
No. States Pwr., (Del.) 8% com.	116½	109½	118
No. Texas Elec., 6% pf.	70	65	70
No. Texas Elec., com.	30	27	36
OHIO BRASS, com. B $4—no par.	82	74	85
Ohio Brass, 6% pf.	105	100	103
Ohio Gas & Elec., 7% pf.	104	95	103½
Ohio Pwr., 6% pf.	102	96	99
Ohio Pub. Serv., $6 pf.	k 95	95	96½
Ohio Pub. Serv., 7% pf.	107½	103	105½
Ohio River Edison, 7% pf.	108	103	108½
Oklahoma Gas & Elec., 7% pf.	101	....	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	38	31	38½
Pacific Pwr. & Lt., 7% pf.	l103½	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 74½	71½	75
Penn-Ohio Edison, 7% pf.	103½	97½	104½
Penn-Ohio Elec., 7% pf.	99	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	103	99	102
Penn-Ohio Pwr. & Lt., 8% pf.	111	109	112
Penn Pwr. & Lt.—$7—no par.	l109	107	108½
Penn Wtr. & Pwr., 8% com.	k190½	175½	192½
Phila. Co., 6% pf.—50.	k 52½	50	53
Phila. Co., com.—50.	103½	85½	110
Phila. Elec., 8% com.—25.	c 51½	46½	54
Portland Elec. Pwr., 7% pf.	99	97½	100
Portland Elec. Pwr., 6% pf.	77	....	....
Portland Elec. Pwr., 6% 2d pf.	50	....	....
Portland Elec. Pwr., com.	24	22	30
Potomac Elec. Pwr., pf.	j108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 6% pf.	l100	99	100
Pub. Serv. of N. J., 6% pf.	101	98½	101½
Pub. Serv. of N. J., 8% pf.	129½	125	131½
P. S. of N. J., $2 com.—no par.	45	32	45
Pub. Serv. of No. Ill., 6% pf.	a103½	102	105½
Pub. Serv. of No. Ill., 7% pf.	a115½	112½	116½
P. S. of No. Ill., com. $8—no par.	a141	140½	143
Pub. Serv. of No. Ill., $8 com.	a142	132	142
Pub. Serv. of Okla., 7% pr. ln.	100	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	107½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	108	105	107
Puget Sound Pwr. & Lt., $6 pf.— no par	87	....	....
Puget Sound Pwr. & Lt., com.	33½	28	34
RADIO CORP. OF AMER.; $3.50 pf.—50	52	49	53
Radio Corp. of Amer., com.—no par.	49	41½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k135	112	135
Rochester Gas & Elec. 6% pf. D.	k103	101	103½
Rochester Gas & Elec., 7% pf. B	k106	105	107
Rochester Gas & Elec., 6% pf. C.	103	101½	103½
SAFETY CABLE, com. $4	65½	52½	65½
San Joaquin Lt. & Pwr., 7% pr. pf.	107	105	108
St. Joseph Ry., L., H. & P., 5% pf.	70	70	73
Servel Corp.	6½	5½	10½
Sierra Pacific Elec., 2% com.	24	....	....
Sioux City Gas & Elec., 7% pf.	103½	99	101½
Southeastern Pwr. & Lt., pf.—$7 no par	l106	....	....
Southeastern Pwr. & Lt., pfe. pf.	k 80	....	....
Southeastern Pwr. & Lt., com.—no par	37½	29½	37½
So. Calif. Edison, 8% pf.	35	36½	38
So. Calif. Edison, 7% pf.	28	27½	28½
So. Calif. Edison, 6% pf.	25½	24½	25½
So. Calif. Edison, 8% com.	34½	31½	34½
Southern Cities Utilities, 7% pf.	85	81	86½
Southern Cities Utilities, com. $4.	37	....	....
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	85	83	86
Southwestern Pwr. & Lt., 7% pf.	k108½	103	108½
Springfield (Mo.) Ry. & Lt., 7% pf.	99	95	100
Standard Gas & Elec., 8% pf.	63	57½	64
Standard Gas & Elec., 7% pr. pf.	109	103	106½
Standard G. & E., com. $3.50—no par	61½	54	61½
Standard Pwr. & Lt., 7% pf.	101½	98	100
Staten Island Edison, pf.—$6—no par	100	99	101
Superheater, $6 com.—no par	180	....	....
Syracuse Lighting, 7% pf.	105½	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.—no par	300	....	....
TAMPA ELEC., com. $2	63½	49	64
Tenn. Elec. Pwr., 6% pf.	96½	92	94½
Tenn. Elec. Pwr., 7% pf.	106	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	l109	106	108½
Tide Water Pwr., 8% pf.	108	105	108
Timken Roller Bear., com.—$4 no par	100½	78	100½
Toledo Edison, 8% pf.	k116½	115	118
Toledo Edison, 7% pf.	l106½	104	106½
Toledo Edison, 6% pf.	k 96	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	95½	90	97
UNITED GAS & ELEC., 6% pf.	101	98	101½
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50.	c108½	89½	108½
United Lt. & Pwr., pf.—$4—no par.	52½	49	53½
United Lt. & Pwr., pf.—$6.50—no par	90½	87	93½
United L. & P., com. A .48—no par.	14	12½	15½
United L. & P., com. B .48—no par.	k 17½	16	18
Utah Pwr. & Lt., 7% pf.	l 108	104	108½
Utica Gas & Elec., 7% pf.	k106½	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95½	93	98
Utilities Pwr. & Lt., com. A $2.	32½	27	34
Utilities Pwr. & Lt., com. B $1—no par	17½	13½	19
VERMONT HYDRO-ELEC., 7% pf.	97½	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 90	68	88
Wagner Elec., com.—no par.	b 30½	18½	34½
Washington Ry. & Elec., 5% com. ex. div	f240	....	....
Washington Ry. & Elec., 5% pf. ex. div.	f 91½	....	....
Washington Wtr. Pwr., 8% com.	150	136	140
West Penn Elec., 7% pf.	108½	102	110
West Penn Elec., Cl. A $7.	106	97½	110
West Penn Pwr., 7% pf.	116	111	118
West Penn Pwr., 6% pf.	m106	100½	107
West Virginia Lt., Ht. & Pwr., 7% pf.	90	94	96
West Va. Utilities, 7% pf.—50.	50	48	51½
Western Pwr., 7% pf.	98	98	101½
Western States Gas & Elec., 7% pf.	100	....	....
Western States Gas & Elec., com.	21	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	77½	67½	77½
Weston Elec. Instrument, com.—no par.	k31½	30½	34½
Weston Elec. Instrument, com.—no par.	k 15½	15	18½
Wheeling Elec., 6% pf.	100	95	97
Worthington Pump, 7% pf. A.	k 58	46	59½
Worthington Pump, 6% B.	k 50½	40	50½
Worthington Pump, com.	38½	20½	40½
YALE & TOWNE com. $5—25.	80	70½	80

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 28. *l*Bid price Wednesday, June 1. *m*Latest quotations available. †Dividend rate variable.

imaginary substitute, the result represents the reproduction value of that portion of the plant actually in use. Isn't that sound business and good common sense?

Now, how does this theory work out in fact? Is it ever possible easily to determine whether a rate is fair or unfair? How can it be if under this theory the rate base is determined by the reproduction value, which in turn depends among numerous other factors on the future plateau of prices of both labor and materials? And so every rate case in such a situation involves an army of experts, involves intensive and expensive study, involves a considerable amount of time and a tremendous expenditure of money. And after you get all of that you haven't a collection of facts, but a collection of judgments of men, a collection of their guesses as to what is going to happen in the future. This has been what the utility has had to undergo in the ordinary rate case. Of course, the ratepayers have to pay for it. It is a part of the operating expense of the utility. How is the public going to meet such a case? Who of the public can afford or will undertake to expend the amount of money necessary to hire experts on the other side to make that same sort of a reproduction valuation? And so, if that theory were carried out to its logical conclusion, there would in effect be no such thing as regulation of rates, because the rates under such a rate base would be higher than those the utility could possibly charge the public and sell its commodity. Now, some utility men may say, "Fine! You can't hurt our feelings by abolishing all regulation of prices." But you must have the public good will for the success of your business. No matter what the utility is, whether or not it is a monopoly, whether it is without any competition or whether it has some form of competition, if the public finds itself helpless to prevent constantly increasing rates in that utility, it will find a remedy for itself in other ways. The remedy for one thing will be a diminished use of the commodity—so diminished that the utility will receive less gross income under the enhanced rates than it would have received under the lower rates.

The public is not helpless against constantly increasing rates. Monopolies exist in the utilities solely by virtue of the consent of the public; they are not inherent in the business. What is inherent in the business is the desirability of monopoly. The nature of the utility is such that, from the viewpoint of efficiency and economic operation, it ought to have a monopoly. But if the aim or policy of the monopoly is exorbitant rates, that monopoly will cease to exist. Parallel or duplicate plants will arise by virtue of the repeal of the statutory laws which prohibit competition and municipalities will enter the field. And

that is not an untried feature, as you know.

There is just one other thing that I wanted to touch on, and that is from another angle, another economic angle. Take a plant that was built in the peak of high prices in 1918, 1919, 1920 and 1921, when we had the highest plateau of prices since the inception of the country, particularly the years 1919 and 1920. Consider, for instance, a plant built during that period, and in 1935, if prices are then considerably lower and the utility is asking for certain rates, we say to it: "You will get rates based on your reproduction value, less observed depreciation. You built your plant at the peak of high prices. Your reproduction value today is 25 or 30 per cent less than what you paid for it, and therefore you will only be entitled to a rate based on half the capital which you invested in that plant rather than on your prudent investment. What is going to happen to that utility if the theory is enforced? Can a plant in which is invested $10,000,000 operate if it is going to be allowed a return on only $5,000,000 of its capital stock? You know and I know that it would take not very long for that utility to be in the hands of a receiver, and yet, under a strict adherence to the reproduction theory, all it would be entitled to would be a return on $5,000,000 instead of the $10,000,000 invested. Or consider a utility—and we have many such—that built the major portion of its plant since the war at high prices. Just now we have prices that are high, but what may happen ten years from now if there should be another downward tendency? Will that utility then be able to operate or to furnish adequate service? The reproduction theory would then cut its rates in half, which would mean a return only on half of its invested capital." It is merely the present moment with its high prices which makes the reproduction theory seem advantageous to utility owners.

In this commonwealth, whatever might be said of some of the Western states, practically from the inception of public utilities there has been regulation with respect to investment in the utility. The company has received, generally speaking, dollar for dollar on its investment. There has been no water put into the stock; and so in this commonwealth, whatever may be the situation anywhere else, absolute fairness and equality of treatment, both toward capital and toward the public, require that, on the economic basis, the reproduction theory should be discarded and the prudent investment theory followed.

Northeastern Pays Initial Dividend.—The Northeastern Power Corporation has declared an initial quarterly dividend of 15 cents a share on its common stock and a regular quarterly dividend of $1.50 a share on its Class A stock, both payable July 1 to holders of record June 15.

New Offerings for May Total $127,200,121

NEW financing by the electric light and power companies of the country during the month of May amounted to $127,200,121. This figure includes the total amount actually realized from the sale of the securities plus rights offered to stockholders and warrants issued. The par value of the new issues totaled $110,435,000, as compared with $125,756,500 in April and $66,316,000 in May, 1926. The par value of the offerings made during the first five months of the current year totaled $722,825,500, against $560,961,442 during the similar period of 1926.

The forty-million-dollar offering of the Columbia Gas & Electric Company in the form of 25-year gold debentures helped to swell the total for May considerably. Although long-term financing predominated, several short-term issues appeared.

Security Issues of Electric Service Companies in May

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Columbia Gas & Electric Co.	$40,000,000	25	Gold debentures	To retire funded debt and preferred stocks of Columbia Gas subsidiaries	5	100	5
United Public Service Co.	2,000,000	15	Collateral trust gold bonds, series A	To acquire capital stocks of subsidiaries to be acquired and for working capital	6	97⅛	6.25
	1,200,000	..	Preferred stocks		7	100	7
	1,550,000	2	Notes		6	99¾	6.15
American Commonwealth Power Corp.	1,000,000	25	Gold debentures, series A	Acquisition of new property	6	96	6.32
	950,000	..	Cumulative first preferred stock, series A		7	95	7.37
United States Electric Light & Power Shares, Inc.	1,462,500	..	Trust certificate, series A		..	29½	6
Atlantic Public Utilities, Inc.	500,000	3	Coupon gold notes	To reimburse treasury for cost of acquisition of stock and for general corporate purposes	6	99⅓	6.18
Central & Southwest Utilities Co.	3,360,000	..	Preferred stock		7	96	7.29
Maysville (Ky.) Public Service Corp.	900,000	15	First mortgage gold bonds, series A		5½	97	5.80
Philadelphia Suburban-Counties Gas & Electric Co.	10,000,000	30	First and refunding mortgage gold bonds	To reimburse the company for its expenditures in retiring bonds of constituent companies, for additions and improvements and for other corporate purposes	4½	95	4.82
Empire District Electric Co.	3,500,000	..	Cumulative preferred stock	To purchase assets of another utility, to liquidate its assumed liabilities and to furnish additional working capital	6	95	6.32
Eastern New Jersey Power Co.	1,000,000	22	First mortgage gold bonds	To reimburse company for additions, extensions and improvements and for other corporate purposes	5	97	5.23
Kansas Power Co.	3,500,000	20	First mortgage gold bonds, series A	To acquire properties, to retire securities of predecessor companies and for other corporate purposes	5	96½	5.28
United Public Utilities Co., (N. J.)	1,850,000	2	Gold notes	To be used in exchange for securities of subsidiaries to be acquired and to be deposited against indebtedness of subsidiaries not acquired	5½	99½	5.90
Suburban Light & Power Co.	2,500,000	25	First mortgage collateral gold bonds, series A	To retire notes, for the acquisition of properties and for other corporate purposes	5½	96	5.80
	500,000	..	Cumulative first preferred stock		7	95	7.35
Galveston-Houston Electric Co.	1,200,000	4	Secured gold notes, series B	Refunding	6	97.41	6.75
Montana Power Co.	12,500,000	35	Gold debentures, series A	To retire entire outstanding issue of 7 per cent cumulative preferred stock	5	97½	5.15
Power Corporation of New York	5,000,000	20	Gold debentures	To retire current indebtedness and to acquire stocks of subsidiaries	5½	100	5.50
Pecos Valley Power & Light Co.	1,750,000	10	First mortgage gold bonds, series A	To increase capacity of the system and to provide working capital	6½	99	6.60
Northeastern Iowa Power Co.	300,000	1	Gold notes		5	99¼	5.17
Middle West Utilities Co.	13,912,500	..	Cumulative non par preferred stock	To acquire new properties and for other corporate purposes	6	92½	6.46

Total amount of issues	$110,435,000 (Par value)
Total amount actually realized	$107,735,551
Rights and warrants	19,464,570
Total financing for May	$127,200,121

Manufacturing and Markets

The House Wiring Situation

Industry Conference on Wiring Shows Differences Between N.E.L.A. and A.E.I. to Be Based on a Misunderstanding—Recommendations of Chairman Clear Up Situation

WHETHER the promotion of a wiring program by the Association of Electragists International was restraining the installation of house wiring, and therefore the development of the electrical industry, or not was definitely settled by the industry conference on wiring and was found to be largely owing to a misunderstanding between the two groups at variance, the National Electric Light Association and the Association of Electragists International. The four major groups of the electrical industry participated in the conference. They are the National Electric Light Association, the National Electrical Manufacturers' Association, the Electrical Supply Jobbers' Association and the Association of Electragists International.

The report of the chairman, Earl Whitehorne, commercial editor of the ELECTRICAL WORLD, was unanimously approved and adopted by the conference and is now being distributed broadly throughout the industry. It did not sustain the charges of the N.E.L.A. that the wiring program of the A.E.I. was restraining the development of the industry. The wiring program of the A.E.I. was known as the "all-metal standard."

The chairman in his report said: "There can be no united opinion in the electrical industry as to how to secure the adequate wiring of the American home until this unfortunate argument between the National Electric Light Association and the Association of Electragists is cleared up. It is confusing the minds of electrical men and beclouding the real issue." In discussing the "all-metal standard" policy and practice and after analyzing the briefs submitted by the two contending associations, the report adds:

> Analysis of the two briefs makes immediately apparent that the National Electric Light Association and the Association of Electragists have entirely different conceptions of what this program is. The indefiniteness of the term "all-metal standard" has clearly caused much misunderstanding. The National Electric Light Association has apparently taken it to mean "metal jobs always and everywhere" and has inferred that the ultimate intent is to make rigid conduit the sole method of wiring. It has apparently lost sight of the fact that the metal wiring program as published embraces four types of wiring construction approved by the National Electrical Code—rigid conduit, flexible metallic conduit, armored cable and metal molding.

Definite recommendations were made by the chairman in his report regarding the all-metal policy. He says:

> It would appear, therefore, that the metal-wiring program as published and defined by the Association of Electragists is not entirely that thing which the National Electric Light Association has taken it to be. Both the N.E.L.A. and the A.E.I. substantially agree as to where metal types of wiring should be used. Both recognize the value of metal-inclosed wiring for use under certain conditions. The Association of Electragists is at fault, however, in having applied to its idea a term so easily susceptible to misunderstanding. Two years ago its executive committee passed a resolution intended to clarify the purpose of this program and again in March, 1927, a further resolution attempted to make the intent of the movement more clear; but in my opinion more than this should be done. I, therefore, recommend to the Association of Electragists that it proceed to restate its position regarding metal wiring, outlining its policy and intent in such terms that they be made simple to understand and incontrovertible in their basic principles, and I urge that hereafter the use of the term "all-metal" and the word "standard" be avoided. This statement should be disseminated broadly throughout all branches of the electrical industry.

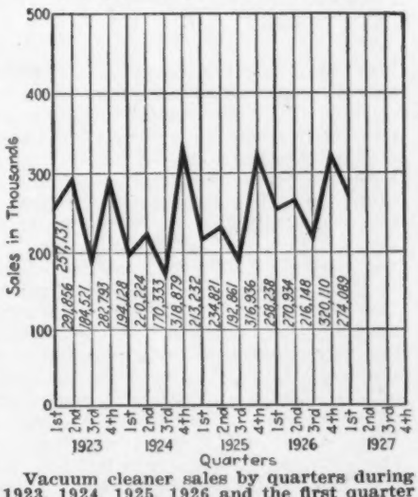
The chairman in his report finds that there is preponderant opinion in the industry that present costs do not interfere with the sale of house wiring. There was no actual proof, but in addition to the evidence in the briefs the chairman solicited opinions from contractors, inspectors and league officials.

COST OF METAL WIRING

The report finds that the difference in cost between armored cable and knob-and-tube work is apparently negligible—more in some places, less in others, with the average indicating an economy for knob-and-tube installations. But the report says: "It is doubtful whether this difference in cost is exciting any influence whatever on the sale of wiring."

In discussing how to speed up the installation of house wiring the chairman finds that there are only two ways possible—(1) by reducing the cost of wiring, and (2) by doing a better selling job. He further definitely analyzes the situation and says:

Vacuum Cleaner Sales



Vacuum cleaner sales by quarters during 1923, 1924, 1925, 1926 and the first quarter of 1927. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

The only laws that can be invoked to reduce the cost of wiring are the laws of economics. Here are the ways in which the cost of house wiring in America can be reduced by the electrical industry:

1. By uniformity of inspection requirements throughout the country.
2. By the elimination of excess and duplicating varieties of materials and equipment made possible by uniform inspection requirements.
3. By a more effective standardization of manufactured products that will increase mass production.
4. By the development of industry statistics in the manufacturing and jobbing fields, to stop the wastes of overproduction and underproduction that today add cost to every wiring job.
5. By the development of economies in our system of distributing manufactured products in the electrical industry.
6. By the possible development of entirely new wiring materials and methods that will contribute new economies either in material or labor costs or both.
7. By the education of the contractor to do a better job in planning the layout of installations and in supervising his men.
8. By the better training of workmen so that wiring can be installed more effectively and more economically.
9. By the development of more effective tools for use in installing materials in order to save labor.
10. By the standardization of central-station service requirements so that construction outside the meter may also be as inexpensive as possible.
11. By the improvement of the business practices of contractors and dealers so that the present high cost of ignorance, incompetence and failure will not also be burdened on every wiring job.

All these are ways in which the cost of house wiring in America can and will be gradually reduced. Visionary? No, each of these suggestions is eminently practical. Each will take time, but each is worth working for. The product of all these influences will be to increase the volume of production and improve the efficiency of handling and the skill of installing. Each will contribute something to reduce the cost of wiring houses. However, the immediate and profitable opportunity for the electrical industry in the matter lies in quite another direction.

The chairman then points to the need for well-organized selling and says: "There is absolutely no observable obstacle to the development of this house-wiring market that intelligent, well-organized selling will not readily overcome."

WHAT TO DO NOW

In considering the carrying forward of the job of rewiring or completing the inadequate installations now blocking progress in nearly 16,000,000 homes scattered throughout every community in America, the chairman made the following further recommendations:

1. That if this report be acceptable to the conference, it be conveyed to the four participating associations with all the supporting evidence—the stenotype reports and minutes of our two meetings and the minutes of the two meetings of your executive committee, the briefs and the copies of all league reports—that our findings and recommendations be reported to the membership of these four associations at the coming summer conventions, and that the report be released to the electrical press on May 15, and as soon as possible thereafter that it be distributed generally to the electrical industry in pamphlet form.
2. That the present delegations of the four national associations of the electrical industry invite these organizations which they represent to appoint new delegations, selecting for each association five outstanding men whom they believe will best represent the sales experience and the spirit and resourcefulness of these several associations, to meet with me in July on a day

to be set, to reorganize under a new chairman for the purpose of formulating a program for the promotion of the domestic market for house wiring, electric service and electrical equipment in the homes of America.

3. That thereupon the present delegations from these associations should be dismissed with thanks and appreciation for their good work well done.

4. That the reorganized conference of sales executives should invite the co-operation and participation of the associations of appliance manufacturers, the lighting equipment manufacturers and dealers and any other organizations of the electrical industry whose aid should be enlisted, and that they take advantage of the services and benefits of all existing organizations and agencies that can contribute to its success, such as, for example, the "red seal" plan and other services of the Society for Electrical Development and the local electrical leagues.

The personnel of the industry conference on wiring was as follows:

Chairman, Earl Whitehorne; representing the National Electric Light Association: W. H. Blood, Jr., A. P. Good, J. D. Noyes and Charles J. Russell; representing the National Electrical Manufacturers' Association: H. R. Sargent, C. A. Bates, R. C. Myer and W. E. Sprackling; representing the Electrical Supply Jobbers' Association: G. E. Cullinan, W. I. Bickford, W. R. Herstein and O. F. Rost; representing the Association of Electragists International: J. A. Fowler, A. P. Denton, W. C. Peet and G. E. Shepherd; technical advisers: Laurence W. Davis, Joseph C. Forsythe, H. B. Kirkland and Alexander Maxwell; observers for the industry: E. C. Bennett, O. H. Caldwell, S. A. Dennis, Howard Ehrlich, Charles T. Hutchinson and S. B. Williams; secretary and treasurer: Eustace C. Soares, and stenotype reporter, L. L. Walsh.

April Activities Slightly Under March

Many Reasons for Believing that Production of Electrical Manufacturing Companies in Coming Fall Months Will Not Be Under Last Year's High Record

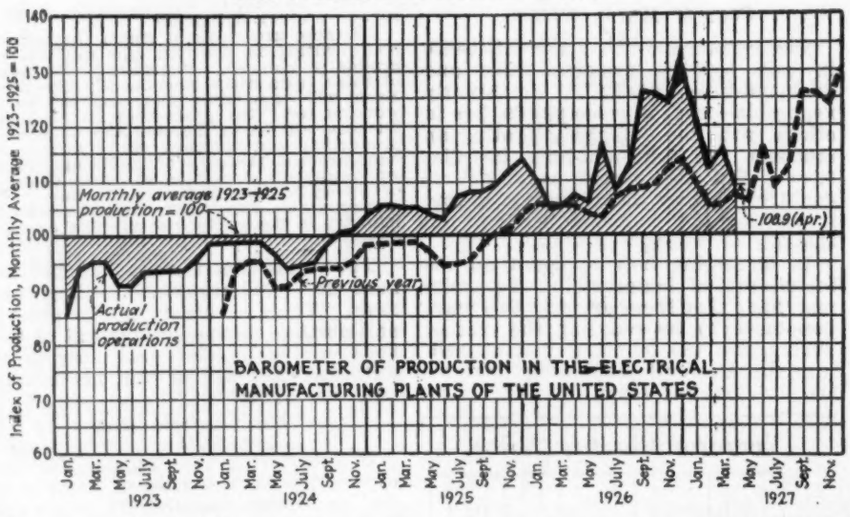
APRIL productive activity in the electrical manufacturing plants of the country as indicated by the monthly consumption of electrical energy was about 2.3 per cent under March after corrections were made for the number of working days in the two months. The actual production, however, was 6.8 per cent under March, but was 1.1 per cent above April of last year. The activity within these electrical manufacturing plants has been on a steady decline since December, the April activity being 19.4 per cent under the high mark recorded during December. A similar recession in activity was recorded during the first four months of last year, but was not of such large extent as during the past four months. The gain in production over April of last year, 1.1 per cent, was the smallest annual gain recorded since July of last year.

A study of the individual reports on energy consumption by electrical manufacturing plants indicates that the productive activities of the larger manufacturing companies were 8.2 per cent under those of March, while the activity of the group of smaller companies was about 0.4 per cent in excess of the March activity, these two activity figures taking into consideration the larger number of working days during March.

Despite the fact that the electrical manufacturing companies as a whole experienced a period of unusually high productivity during the fall months of last year, there are many reasons which would seem to indicate that the production of these companies during the coming fall months will not fall under that of the same period of last year. General credit supplies continue in abundance; the construction budget of the electric light and power companies for 1927 is 14 per cent over that reported for 1926; the consumption of electrical energy for the first third of the year was about 10 per cent over that of the first third of last year; monthly reports of customers added to the lines during the first four months of the year indicate little if any recession from the additions made during 1926; new capital borrowings by the electric light and power companies for the first four months totaled $315,740,000, which, while some 10 per cent under the same period of last year, is yet of such proportions as to indicate little if any recession in new generating, transmission and distribution construction, and contracts let for heavy construction from January through April were virtually the same as for the same period of 1926. The only outstanding indication of a possible recession in the demand for electrical equipment, apparatus and supplies lies in the fact that the contracts awarded for residential buildings and apartment houses for the first four months of the year were about 5.5 per cent under last year, but this degree of decrease, at least up to the present time, is not sufficient to overcome the normal growth in demand for new electrical commodities from the present central-station customers. Industry may look with confidence toward a high rate of production following the dull period normally prevalent throughout general industry during the summer months.

Industry in general appears to continue on a plane of high productivity. Several outstanding economists are now saying that the period of good business and high industrial productivity which has been witnessed during the past two years is not abnormal, in fact, is slightly subnormal, if the natural growth of production is taken into consideration. These students of industry look for continued high production, with possibly a slight letdown during the coming summer months. Many are now prophesying real boom times by the end of the year, and another good year in 1928.

Data Unadjusted for Seasonal Variation



Power and Production per Wage Earner in Canada

The Census of Manufactures of the Dominion of Canada for the year 1925, a summary of which has been made public by the Dominion Bureau of Statistics, brings out the material increase both in the use of power and the production per wage earner in the manufacturing plants of the Dominion since 1919. Approximately 63,000 fewer wage earners were employed in 1925 than in 1919, the reduction amounting to 11.9 per cent. Compared with 1923 there was an increase of about 4.34 per cent.

During the same six-year period the number of manufacturing plants has decreased from 23,249 to 22,331, a reduction of 3.95 per cent. The average size of the plants in terms of number of employees has decreased from 22.7 in 1919 to 20.9 in 1925. Corresponding with the diminution in number of wage earners, production decreased by 9.87 per cent below 1919. Production is here taken in terms of the "value added by manufacture," which was $1,509,870,745 in 1919, dropped 19.93 per cent in 1921, fell by about $200,000,000 below the earlier figure in 1923, but rose by approximately $50,000,000 in the next two years to $1,360,879,907 in 1925. This value created by manufacturing processes is pointed out as a better measure than the total value of finished output, because the products of many establishments are used as materials by other establishments and the aggregate value of finished manufactured products

($2,948,545,315 in 1925) is considerably in excess of the total value in the form in which they reach the ultimate consumer.

As might be expected in view of these contrary movements, the increased production per wage earner, which rose from $2,852 in 1919 to $2,918 in 1925, was accompanied by a considerable increase in installed primary horsepower, the actual change being from 2,777,577 to 5,055,644. This is an 82 per cent gain in six years. The growth in horsepower per wage earner is even more striking, exceeding 106 per cent.

Economic Conference Justifies Itself

Accomplishments of the International Meeting at Geneva Promise to Be Tangible as Regards Trade Barriers, Industrial Organization and International Statistics

BY E. J. MEHREN
Vice-President McGraw-Hill Publishing Company, Inc.

GOODLY accomplishment can be credited to the International Economic Conference, just adjourned at Geneva, which recommended the removal of hampering trade barriers, declared the value of an efficient industrial organization as an aid to economic recovery, traversed the function of international industrial pools, and urged international statistics that should result in more intelligent management for industry and agriculture.

The most tangible work was on the removal of trade barriers, since the league was asked to convene for a conference to secure official accords and the International Chamber of Commerce will undoubtedly push the recommendations. Action seems probable, but results will not follow immediately, since government machinery necessarily moves slowly and careful study is needed on the simplification of tariff schedules, standardization, nomenclature, etc.

But accord established many important points, which is the necessary first step for effective action. Probably the most notable commerce recommendation is tariff stabilization, making long-term contracts possible. America will profit as well as Europe. Of industrial resolutions, that on rationalization is especially important because of the intense European interest in the subject. To us such declarations seem obvious, but not so in Europe until this conference. Of special importance was the declaration that labor should cooperate. How much more rapid our scientific management movement would have been had labor been party to it! Europe, about to begin intensive rationalization, starts right by getting labor's help.

On international cartels the conclusion is very general. A cartel is good if not exploitive, if it does not bring industrial self-sufficiency and stifle technical progress. Clearly such international agreements are in an early stage of development, and the conference wisely withheld positive judgment, counseling study and publicity.

Highly to be commended are proposals for the collection of world statistics on raw materials and agricultural products and the studies of basic materials in which a world shortage is most feared. Intelligent world economy in industrial and agricultural production and marketing is not possible without such figures and studies.

Aside from these recommendations and conclusions, there are broader benefits. The world has now a clear understanding of its economic ills, knows what the ablest specialists think are remedies, and thus a basis for action is laid. But quick results must not be expected. Problems are large and complicated. Much time would be required for national solution and even more for international solution.

While the conference was called primarily to consider Europe's difficulties, it must be apparent that America will benefit. She will gain from freer trade due to the removal of European trade barriers, will gain from sound, adequate international agricultural and industrial statistics, and, finally, Europe in economic health will be a better customer than Europe in ill health. The International Economic Conference would seem to have justified its being.

OPENING SESSION OF INTERNATIONAL ECONOMIC CONFERENCE AT GENEVA

Business Conditions

SALES for the past week in the electrical industry have been in fair volume, but somewhat below those for the same period last year. Activities in the textile field in the Southeast have been a feature, one order by a Tennessee firm amounting to $25,000 for motors, transformers and switchboard equipment. Business in the New England district has been well maintained, with a steady demand for small motors, poles and line material. Domestic electric appliances are selling in somewhat greater volume than a year ago, according to the report of one jobber. The New York territory appears to be suffering a general depression, sales of switching equipment, line hardware and poles moving very slowly. Business conditions have improved in the Middle West, although building activity lags. Electrical refrigeration sales are good, and appliances of the gift type are moving in excellent volume. On the Pacific Coast machinery orders have been divided almost equally between industrial and utility plants. Porcelain insulator orders included two carloads valued at $12,500. Seattle jobbing concerns have had a comparatively dull week. Aside from a few small motor sales for irrigation projects in eastern Washington and some orders for replacements in lumber and shingle mills in the Puget Sound area, the activity registered has been negligible.

From figures published by the National Electrical Manufacturers' Association for the first quarter of 1927, supplemented by the published reports of some of the larger companies, it is revealed that the General Electric Company's business for the first three months compared with the same period last year shows a decrease of 10 per cent, Westinghouse a decrease of 3 per cent and Allis-Chalmers a decrease of 2 per cent, while all the other companies that reported showed that their business in the first quarter of this year was about the same as last year.

President Swope of the N.E.M.A., in commenting on these figures before the annual meeting held at Hot Springs, Va., this week, said that they show clearly that the business of the electrical industry as a whole in the first quarter was running at a rate somewhat less than in the same period last year but that the decrease is not so great as in other industries. "In the electrical industry we have been led to expect and believe that our normal line of comparison should be an increasing one," Mr. Swope said. "The outlook for business for the remainder of this year seems to me favorable, from all the indications that one can see, and we can look with confidence, if we know how to conduct our business, to increasing orders and, with good management, to greater profits."

Copper Approaches 12¾ Cents—Lead Easier

A distinctly better feeling exists in the non-ferrous metal markets than prevailed a week ago. Copper, which sagged to 12⅛ cents delivered in the East, recovered sharply and on a good volume of business approached 12⅞ cents Wednesday, one or two sales at 12⅝ cents making it impossible to quote the even quarter. Zinc likewise advanced from 6 cents to 6.10 cents during the week, though the market was not active. Lead is down ten points from a week ago, but business has picked up, and the tone of the market seems good.

NEW YORK METAL MARKET PRICES

	May 25, 1927 Cents per Pound	June 2, 1927 Cents per Pound
Copper electrolytic	12.525	12.725
Lead, Am. S. & R. price	6⅛	6.40
Antimony	13¼	12¼
Nickel, ingot	35	35
Zinc spots	6.35–6.375	6.45
Tin, Straits	67⅛	67⅛
Aluminum, 99 per cent	26	26

Base copper price June 2, 1927, 14¼ cents.

Among the large domestic buyers have been brass companies and manufacturers of electrical equipment. There are some indications that wire business is slacking off. Deliveries specified are principally for June and July, although August and even September are represented by good sales. Sentiment among producers seems to be better than it has been for some time, but, on the other hand, consumers cannot be said to appear worried.

Sales in Southeast Show Variety and Volume

Southeastern central stations continue to buy only for current needs in small orders, but the total volume of business has been fairly satisfactory and inquiries for substation equipment and transmission-line materials are in excellent volume. One company ordered elevator equipment last week amounting to $6,500 for use in connection with the changeover of a direct-current underground system to alternating-current service. Other central-station orders call for $4,500 worth of distribution and small power transformers and $3,700 worth of house-type meters. There is a good sprinkling of orders for cable insulators and switching equipment. "White-way" equipment sales are about normal. Lamp sales are good, and the dollar volume is about equal to that of this period last year, despite the recent price reductions. Construction activities are lagging, and purchases by contractors are slow, with little prospect for an early pick-up. Activities in the textile field are brisk, several jobs having been closed recently in both electrification and new-construction lines. One order placed by a Tennessee textile plant last week was for $25,000 worth of motors, transformers and switchboard equipment. Electric refrigerator sales are excellent, particularly in those sections where central-station campaigns are in progress. Electric range sales are also reported good, with one power company selling more than a thousand ranges in a six weeks' campaign.

Industrial Buying in New York District Continues Fair

The demand for all kinds of apparatus for public utility use in the New York district is dull. Switching equipments, circuit breakers, line hardware, poles and cross-arms are moving very slowly, sales being generally small and few inquiries being reported for this apparatus. Transformers are slightly stronger. One manufacturer in this line reports sales this month slightly better than April, but a total volume of business this year less than for the same period last year. Industrial buying continues good, makers of motors and control apparatus reporting a good demand for small and medium-size equipments.

Moderate Activity for Week on Pacific Coast

Machinery orders, divided among industrial and power companies, have been a feature on the West Coast. A flour company has purchased a 500-hp. supersynchronous motor which, with accessories, totals $9,000. A Hawaiian Island sugar plantation has bought a seventeen-panel switchboard worth $13,000. The St. Stanislaus irrigation district has voted $200,000 in bonds for the purchase of a power line complete with pole equipment and power apparatus. Special inquiries from power companies include one for a carload of creosote. A power company in the Hawaiian Islands purchased 60 transformers in sizes from 5 kva. to 15 kva., valued at $7,000. A carload of 90 Westinghouse electric ranges, valued at $11,000, has been bought by a San Francisco jobber.

The Board of Public Works of the City of San Francisco has awarded contracts for the transformers, switchgears, switchboard and disconnecting switches of the new Livermore substation. This station will care for the Coast Range Aqueduct construction of the Hetch Hetchy water supply, stepping down the 110,000-volt line from the Moccasin Creek plant to 22,000 volts. Delivery is to be completed by Sept. 15. Details of the awards are: To Allis-Chalmers Manufacturing Company, four 2,000-kva. transformers, primary 154,000 volts, secondary 23,000 volts, and 41 distributing transformers, 23,000 volts to 230 volts, of which thirteen are 15-kva., thirteen 200-kva. and fifteen 100-kva., the total value being $72,125; to H. B. Squires Company, representing the Condit Electric & Manufacturing Company, switchgears and switchboard, $40,600; to Garland-Affolter Engineering Company, Champion disconnecting switches, $5,648.

Motor and apparatus sales reported by Seattle jobbing concerns during the week were negligible, with the exception of a few small motors for pumping plants in eastern Washington irrigation and larger ones for replacement purposes in lumber and shingle mills in Seattle and the Puget Sound area. Electrical machinery and equipment for one or more large pulp and paper projects in the Gray's Harbor district will be purchased during the summer, and a million-dollar electrified lumber mill will be built in Longview, Wash., by the Weyerhauser interests.

Trade Steady in the New England District

New England business was marked by a steady demand for small motors, poles and line material, safety switches, wire and cable. A large amount of industrial-plant betterment work is under way, and there is a good deal of electric wiring in progress for small stores and restaurants catering to the motorist. Electric signs are moving well for this time of year. Many active propositions are under consideration in the electric heating field, and there is a good sale of motors for oil-burner applications. Harvard University recently purchased about $18,000 worth of small motors, switchboard panels and wiring material. Interest in improved lighting of buildings is well sustained and street-lighting business is doing well. Sales of industrial electric trucks are running above last year's totals and one house reports a gain of 45 per cent in units sold, prices having remained steady. A new combination coal and electric range is being well received, although volume sales have not yet been attained. Domestic electric appliances are selling on an excellent scale, one syndicate reporting sales aggregating $246,369 thus far this year, compared with $226,895 for the same period of 1926. Wiring supplies for interior work are not quite so active, but several carload orders for outside service have been booked.

Distribution Materials in Demand in Middle West

Building activity is particularly slow in the Middle West with a number of projects contemplated but few started. Construction work in progress is being completed, but new work is being held up. There has been a good demand for all kinds of distribution materials, and manufacturers of pole-line hardware are still working double time. Jobbers report a fair amount of business transacted. Appliances of the gift type are moving in considerable volume, particularly flatirons, toasters and grills. Electrical refrigerations sales are good, adding materially to the volume of business.

Activities of the Trade

Copperweld Steel Company Buys Plant at Glassport

The plant of the Kelly Axe & Tool Company, Glassport, Pa., has been purchased by the Copperweld Steel Company, Rankin, Pa., and the purchaser will occupy it soon, following the installation of rolling mills, already purchased, and the completion of some minor changes to the plant. The new plant will give the company ten acres under roof, or five times the floor space in its present works. Machinery which has been purchased will permit of tripling the present production. The company will move only such equipment from the Rankin plant as will be serviceable in the new location.

Production of General Electric Refrigerators Increases Steadily

Production of General Electric refrigerators has been under way since February in two of the company's factories, at Fort Wayne, Ind., and Schenectady, N. Y., and there has been a steady increase in the output each month, according to an announcement by B. P. Zimmerman, sales manager. Plans are said to be under way for increasing this production still further from now until September, by which time more than one hundred distributors and several thousand dealers will be fully organized in all important trading centers of the country. The company plans a national advertising campaign, which will be supplemented by an extensive newspaper campaign in which the dealers and distributors will co-operate.

Philadelphia Manufacturing Company Expands Activities

The Philadelphia Electrical & Manufacturing Company, 1228 North Thirty-first Street, Philadelphia, has entered actively into the field of ornamental cast-iron and concrete lighting standards. For many years the company has been engaged in the manufacture of standards in connection with its lighting units. The company says that the new units are readily accessible and easily wired standards for series lighting where heavy cable is used and potheads are required and that it has embodied many features to eliminate delay and facilitate the work of the wiremen.

A recent development of the company has been a trolley bracket. This is fitted with a "Pemco" shock-absorbing device which prevents the lamp from unscrewing or the filament breaking because of the destructive vibration often set up in a lamp supported from a trolley pole. The units are so constructed that they will hang vertically regardless of the angle of the trolley pole to which they may be attached. A shock absorber for supporting industrial lighting units for factories has also been developed along the lines of the large shock absorber. This provides a spring support for the lamp, eliminating destructive vibration. These units are said to be used extensively on elevated railroad platforms and under bridges. Several new designs of series units and bracket arms are shown in bulletin No. 32, issued by the company, which also announces that a new general catalog is being compiled and will be published early in June.

Crocker-Wheeler Elects Officers

The Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., at a recent meeting, re-elected the following officers: Edmund Lang, president; H. C. Petty, vice-president and secretary; A. L. Doremus, vice-president; G. W. Bower, assistant treasurer, and E. C. Jones, assistant secretary. William H. Coade, who at one time was connected with the organization for a number of years, was also elected treasurer at that meeting.

The Iroquois Electric Refrigeration Company, 1600 Arch Street, Philadelphia, announces the appointment of Seeber & Hofheins, 861 Main Street, Buffalo, as distributors for Buffalo and western New York.

The General Electric Company today announced a 5 per cent reduction in prices of distribution transformers and small power transformers, effective June 1. This reduction is the **sixth** since 1920. On certain types of large transformers reductions which average 5 per cent for this class of product have also been made. According to J. G. Barry, vice-president, these reductions are made possible by economies resulting from improved engineering and manufacturing methods and from standardization.

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., manufacturer of porcelain and electrical supplies, announce the appointment of C. L. Nicholson as general sales manager. Since 1919 Mr. Nicholson has been with the organization, serving first as production manager and later as assistant general sales manager.

The Star Fuse Company, Inc., New York City, announces that it is now established at 235 Canal Street.

The Robbins & Myers Company, Springfield, Ohio, at the annual meeting elected the following directors: M. H. Murch, W. S. Quinlan and R. V. Mitchell all of Cleveland; F. A. Hunting, Harvey E. Freeman, Wilbur J. Myers and Paul A. Staley, all of Springfield.

The W. N. Matthews Corporation, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, announces that L. B. Graves, 91 South Eleventh Street, Minneapolis, will represent the company in Nebraska, with the exception of a small part which is in the territory of its Denver office; all of Iowa except the small part covered from the Chicago district office, and part of Illinois. The company also announces that M. P. McClure, with headquarters at 305 Seventh Avenue, Pittsburgh, succeeds J. A. Jaques as district representative in that territory. To J. L. Reighart, representative in the Louisville district, with headquarters at 88 Kenyon Building, Louisville, additional territory has been given, including most of West Virginia and parts of Ohio, Kentucky and Maryland. D. C. Griffiths, representative in the Cleveland territory, with headquarters in the Rockefeller Building, Cleveland, has had added to his territory several counties in Ohio. A. Clement Hansen, Jr., has also joined the engineering department.

The International Combustion Engineering Corporation, International Combustion Building, 200 Madison Avenue, New York City, announces that William B. Senseman has been appointed Pacific Coast district manager for its subsidiaries, the Combustion Engineering Corporation, the Raymond Brothers Impact Pulverizer Company, the Ladd Water Tube Boiler Company and the Heine Boiler Company. The new consolidated offices are in the Subway Terminal Building, 417 South Hill Street, Los Angeles. Mr. Senseman has been associated with the Raymond company for the past fifteen years and since 1917 has represented that organization on the Pacific Coast.

The Lincoln Electric Company, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the appointment of the Wade Engineering Company, 1855 Industrial Street, Los Angeles, as distributor in California. The Wade company also maintains a branch at 69 Webster Street, Oakland. Both the main office and the branch office will carry a stock of Lincoln products as well as service parts.

Westcott & Mapes, Inc., 139 Orange Street, New Haven, Conn., engineers and architects, have recently opened an office in the Woolworth Building, New York City, with R. Wilbur Tietjen in charge. The company also announces that James S. Hedden, previously connected with the Mark Eidlitz Company of New York City, has recently joined the organization as engineer in charge of construction.

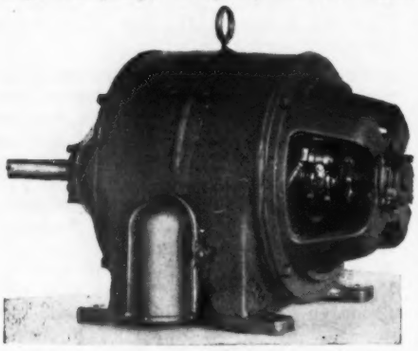
The Electric Controller & Manufacturing Company, Cleveland, announces the appointment of J. B. McCarthy, 307 Reford Building, Toronto, and W. P. Robinson, 808 Drummond Building, Montreal, as its representatives. The company also announces the appointment of the Petroleum Electric Company, 217 East Archer Street, Tulsa, Okla., as its representative in Oklahoma and the Panhandle district of Texas.

The General Electric Company has declared a quarterly dividend of $1 in cash on the common stock, placing it on a four-dollar annual basis against $3 previously. The extra dividend of $1 in cash probably will be in lieu of the extra distribution of $1 in special preferred stock usually declared annually. This action of the board of directors raised the dividend to the equivalent of $16 a share of stock outstanding prior to May 28, 1926, or double the dividend rate existing at that time.

New Equipment Available

General-Purpose Motors

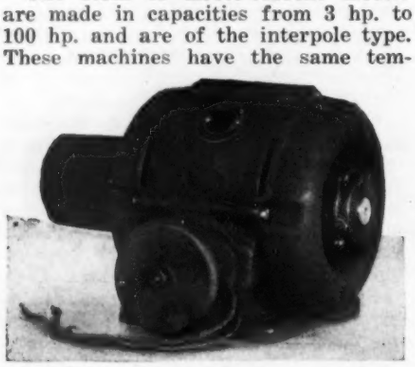
A complete new line of ball-bearing general-purpose motors for both direct-current and alternating-current service has been placed on the market by the Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J. The



FORM F—DIRECT-CURRENT BALL-BEARING MOTOR

form F direct-current motors are made in sizes from ⅝ hp. to 7½ hp. The machines are rated for a 40 deg. C. temperature rise at full load with a 25 per cent two-hour overload at a 55 deg. C. temperature rise. Inclosing or semi-inclosing covers can be fitted to the machines without the removal of either bearing bracket, the rear-end covers being bolted in place while the front covers are hinged and provided with latches. All terminals are brought out to a junction box so that no internal changes are necessary when machines are to be used in reversing service or are separately excited. These machines can be wound for operation as generators in standard capacities from 0.55 kw. to 5 kw. at 125 and 250 volts.

The form H direct-current motors are made in capacities from 3 hp. to 100 hp. and are of the interpole type. These machines have the same tem-



FORM P—BALL-BEARING INDUCTION-MOTOR SQUIRREL-CAGE TYPE

perature rating as the form F. They are available in either the shunt, compound or series type for 115, 230 or 550-volt operation at constant or adjustable speed. They are also made in the semi-inclosed or fully inclosed types and can be furnished with or without a junction box.

The form P induction motors are of the squirrel-cage type for either two-phase or three-phase operation and are available in ratings from ½ hp. to 10 hp. at 60 cycles and ¼ hp. to 5 hp. at 25 cycles. The rotor core is made up of laminated sheet-steel punchings, and the copper rotor bars are cast welded into copper alloy and rings. The form Y induction motors are also of the squirrel-cage type for two-phase or three-phase operation and are rated from 10 hp. at 1,200 r.p.m. to 100 hp. at 1,800 r.p.m. Open slots are used in the larger sizes. The form Y machines will supersede the company's line of form Q machines.

Split-Core Current-Measuring Set

A split-core current-measuring set that is especially valuable in determining the load on feeders or distribution networks is being marketed by the General Electric Company. Each set consists of a transformer with a hinged magnetic circuit, leads and one or more ammeters. The manufacturer claims that it can be used to advantage when it is not required that the accuracy be of the order that can be obtained only with self-contained ammeters or portable current transformers and ammeters. The set can be clamped about the conductor with one hand as it is operated like a pair of pliers. In the case of overhead lines the transformer can be clamped from below, thus avoiding the necessity of reaching over high-voltage lines. Flexible multi-conductor leads 50 ft. long are supplied with each set.

Two sizes of transformers are supplied, one having a window opening of 1¼ in. and the other 2¼ in. in diameter. The former is rated 75/125/250 amp. primary, 2.5 amp. secondary, when used with a single indicating ammeter. This transformer is also supplied with two indicating ammeters, one having a 2.5-amp. winding, the other a 5-amp. winding. The transformer when so used is rated 75/125/250:2.5 and 150/250/500:5 amp. A switch on the ammeter permits reading on both scales without changing connections. The scale reads directly in primary amperes. The recording instrument listed as standard with the sets is the type CRP-4, a portable round-pattern instrument with an 8-in. diameter 24-hour chart and a one-day clock. Other chart speeds as well as eight-day clocks or Warren motor-driven clocks can be furnished if desired.

CO_2 Meters

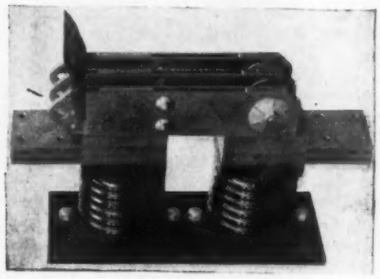
An electrical CO_2 meter based on the thermal conductivity method has been developed for boiler-room use by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia. The company says that the performance of the meter is based on more than four years of research and development followed by two years of trial service tests on numerous instruments installed in power plants. The instrument is guaranteed to be accurate within one-half of 1 per cent CO_2.

Pantograph Switch

The S.&C. pantograph switch made by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, heretofore made for voltages above 7.5 kv., is now available for 2,200-volt to 7,500-volt service. While the construction of the contact clip of the 7,500-volt pantograph unit is different from the one used on the higher-voltage switches, the manufacturer claims that it also is self-aligning, self-cleaning and has liberal contact surfaces. The 7,500-volt pole-top pantograph is intended for mounting on two standard cross-arms, but may be arranged on cross-arms to suit any of the usual service conditions. It can also be supplied in combinations including the S.&C. fuse and choke coil.

Disconnecting Switch

A 4,000-amp., 7,500-volt, single-pole, single-throw, front-connected, indoor-type disconnecting switch with terminals for bolting directly to flat busbars had been developed by the Delta-Star Electric Company, Chicago. The unit type 6-in. diameter insulators are the same as used on the Delta-Star heavy-duty busbar supports.



DISCONNECTING SWITCH WITH GRAVITY LOCK

The gravity lock prevents opening of the switch until lifted by the usual switch stick employed for opening the blades. When desired fittings can be supplied to permit connection of vertical buses of any desired size.

Floodlight Projector.—A 24-in. floodlight projector, known as the type SCA-24, has been developed by the Westinghouse Electric & Manufacturing Company particularly for railroad-yard lighting and similar applications where long-throw and high-beam candlepower are essential. The company claims that the large diameter of the reflector in the new floodlight makes possible a wide angle of light with a high overall efficiency, while its long focal distance gives good beam concentration for long-range work.

Steel Meter Racks.—A steel meter rack has been placed on the market by the Berger Manufacturing Company, 307 Dorchester Avenue, South Boston, Mass. The rack is built of special construction uprights and cross-members and is also double-faced so that the meters can be hung on both sides of the rack. The cross-members are adjustable, each side being adjustable independently of the other. Special screws are used for hanging the meters and the meters can be staggered alternately on first and second rows.

New Trade Literature

AUTOMATIC SWITCHING EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-14A, describing its automatic switching equipment for sectionalizing and reclosing service. Bulletin GEA-89A issued by the company covers the "G-E" automatic switching equipment for outdoor alternating-current reclosing feeder service, from 440 to 73,000 volts. These switches are available in two distinct lines, one using oil circuit breakers of the standard indoor type and the other including an outdoor oil circuit breaker.

SEAMLESS STEEL PRODUCTS. — A booklet issued by the Seamless Steel Equipment Corporation, 26 Broadway, New York City, describes and illustrates the seamless-steel forged-rolled-drawn products for high-pressure and temperature requirements. Dimension tables giving the dimensions of various types of containers and tubing are included.

STEAM PRODUCTION. — "500,000 Pounds of Steam per Hour from One Unit" is the title of publication IC-2 issued by the International Combustion Engineering Corporation, 200 Madison Avenue, New York City, which contains a complete description of remodeled unit No. 2 at the Fordson plant of the Ford Motor Company, together with data relating to its performance. Reproduction of charts showing steam flow from Unit No. 2 are included.

FLOODLIGHTING PROJECTORS. — Bulletin No. 236, issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, describes its "Golden Glow" floodlighting projectors for use in railroad yards, storage areas, crane runways, construction projects and other industrial applications. Dimension diagrams are included. Attention is also called to the "Golden Glow" pendent lighting unit for industrial lighting under the more severe conditions.

BLOWERS. — A folder issued by the American Blower Company, Detroit, describes the "Sirocco" blowers for domestic and industrial oil burners. Illustrations showing typical applications of the blowers are shown. A dimension table of "Sirocco" fans for oil burners is included.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

Middle Atlantic States

LITTLE VALLEY, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, has applied for permission to extend its lines in Little Valley.

NEW YORK, N. Y.—The Board of Estimate has authorized an expenditure of $14,000 to extend the traffic signal light system in the Bronx.

OTISCO, N. Y. — Permission has been granted the Syracuse (N. Y.) Lighting Company to extend its transmission lines in the town of Otisco, and also approval of a franchise granted by the Town Board.

YONKERS, N. Y.—The New York Central Railroad Company, New York, plans to double the output of its local electric plant. The company also plans to build substations at Dykeman Street, 133rd Street and at Sixty-sixth Street, for use in connection with the electrification of its lines.

LAKEHURST, N. J.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 15, for an automatic refrigerating unit; also for a cold storage refrigerator with display window, at the Naval Air Station. Specification No. 5376.

ST. MICHAELS, MD.—Application has been made by the St. Michaels Utilities Commission to the Public Service Commission for permission to extend the municipal electric distribution system along the State Highway from the town limits of St. Michaels to Claiborne.

NORTON, VA.—Extensions and improvements are contemplated by the Old Dominion Power Company, a subsidiary of the Kentucky Utilities Company, Louisville, including the erection of an additional circuit to the 33,000-volt steel tower transmission line from Pocket to Imboden, installing switching equipment at Big Stone Gap and Pocket, etc.

WASHINGTON, D. C.—Bids will be received by the Board of District Commissioners, District Building, Washington, until June 7, for tubular steel poles for the electrical department.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, Signal Corps, Washington, until June 14, for field telephone switchboards in lots of 7 to 22 (Circular 26390-1).

North Central States

APPLE CREEK, OHIO.—Plans are being prepared by H. B. Briggs, Ohio-Hartman Building, Columbus, for a new institution for the Feeble Minded to be erected at Apple Creek, to cost about $650,000. The plans include administration building, cottages, power plant, etc. J. C. Harper, Oak and 9th Streets, Columbus, is director of Public Welfare.

CLEVELAND, OHIO.—Separate bids will be received by the Commissioner of Purchases and Supplies, City Hall, until June 10 for subway type oil switches and fiber conduit for the Division of Light and Power.

OAK PARK, ILL.—Bids will be received by the Board of Local Improvements until June 14 for the installation of an electric street-lighting system in the village of Oak Park, consisting of about 37,000 street lamps, including standards, fixtures, etc., also about 1,500,000 lineal feet of copper cable, transformers, conduits, substations. B. C. Brandstadt is secretary of Board of Local Improvements.

CAGLES MILLS, IND.—The Eel River Power Company, care of the Mead-Balch Construction Company, Indianapolis, is planning to build a hydro-electric plant on the Eel River, near Cagles Mills. The cost of the initial unit with transmission system is estimated at $2,500,000.

ADRIAN, MINN.—The City Council is considering the installation of additional equipment in the municipal electric light and water plant.

DONALDSON, MINN.—The City Council is considering establishing an electric light and power system. Substation equipment will be installed.

DULUTH, MINN. — Improvements involving an expenditure of $1,250,000 during 1927 has been approved by the directors of the Minnesota Power & Light Company. The work will include a substation at Hibbing, to cost about $100,000; a new substation at Little Falls, a high-tension line from Virginia to Soudan, and from Winton to the Pioneer mine and also improvements at Duluth.

FAIRMONT, MINN.—The installation of a 1,000-kw. generator and accessory equipment at the municipal power station is under consideration.

TYLER, MINN.—Improvements to the municipal electric light plant are under consideration by the City Council.

ST. LOUIS, MO.—Bids will be received by George J. Dietz, supply commissioner, until June 17 for two steam turbine driven generators for the Howard Bend waterworks station on the Missouri River at Hine. The cost is estimated at $30,000.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, Room 208, City Hall, until June 28 for a complete power and lighting switchboard for the Howard Bend waterwork station on the Missouri River at Hine. The cost is estimated at $11,000.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, until June 28 for the installation of 4,400 concrete lamp standards, complete with lamps, etc., for the district between the Mississippi River, Grand Boulevard, Arsenal Street and Bates Street. The cost is estimated at $900,000.

BISMARCK, N. D.—The Hughes Electric Company is planning to erect a transmission line from Flasher to New England and vicinity.

VEBLEN, S. D.—The Otter Tail Power Company, Fergus Falls, Minn., which has acquired the local electric plant, plans to erect a transmission line from Geneseo, N. D., to Veblen for local service. The company has also purchased the electric plant at Forman, N. D., where line extensions will be made.

ALBION, NEB.—The Central West Public Utilities Company contemplates improvements to its local system, including enlarging the present plant or purchasing power from a high-tension line and also improvements to the distribution system.

Southern States

ORIENTAL, N. C.—The Neuse Electric Company, Kinston, which has been granted a franchise here, is extending its transmission line from Grantsboro to Oriental, a distance of about 12 miles.

WILMINGTON, N. C.—Plans are under way by the Tide Power Company to extend its transmission line from Whiteville to Tabor, and also to furnish electricity in Loris, S. C. Arrangements have also been made by the company with the Carolina Power & Light Company, Raleigh, for the erection of a transmission line between Baldenboro and Clarkton to provide an additional exchange point between the two systems. One-half of the proposed line will be built by the Tide Water Power Company and the other half by the Carolina Power & Light Company.

PARRIS ISLAND, S. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 15 for a 625 kva. turbo-alternator, including switchboard panel, wiring, etc.; also until June 22, for a 500,000 gallon reservoir and ash conveyor system, etc., at the local Marine Barracks.

ATLANTA, GA.—Bids will be received by the Superintendent of Prisons, Department of Justice, Washington, D. C., until June 10, for equipment for the power house at the local institution, including electrical material, ash-handling equipment, etc.

McRAE, GA.—The Georgia Power Company, which has purchased the municipal electric plant, plans extensions and improvements to the system.

PENSACOLA, FLA.—Plans are under consideration by the City Commissioners and the officials of the Gulf Power Company for extensions to the street-lighting system. It is proposed to extend the lighting facilities to cover the entire city. The ornamental lamps in the business section will probably be changed from the three cluster to single lamps.

CARTHAGE, TENN. — A number of changes are contemplated by the Tennessee Electric Power Company, Chattanooga, in this part of the state, which will include rebuilding the distribution systems in Carthage and Hartsville, reconstruction of the high-tension line (work now under way) between Carthage and Gordonsville.

WATERTOWN, TENN.—An election will be held July 7 to vote on the proposal to issue $10,000 in bonds for the erection of a transmission line to secure electricity for the city lighting system.

JACKSONVILLE, TEX.—The Gulf Public Service Company plans to erect a transmission line from Jacksonville to Troup 25 miles long, to cost about $40,000.

Pacific and Mountain States

CHELAN, WASH.—Plans are under way by George D. Brown & Sons, Inc., for a cold storage and refrigerating plant, to cost about $100,000.

MORTON, WASH.—The City Council is considering an issue of $40,000 in bonds to construct an electric distribution system and to erect a transmission line to connect with the Tacoma municipal electric plant at La Grande.

MEDFORD, ORE.—Plans are under way by the California-Oregon Power Company, San Francisco, to double the output of the hydro-electric plant on the Rogue River, now under construction, by installing a second 22,000-hp. unit, increasing capacity of the plant to 44,000 hp.

LAKEPORT, CAL.—The California Light & Telephone Company is planning to erect a transmission line to the quicksilver mining district in the Sulphur Banks territory, to cost about $25,000.

LOS ANGELES, CAL.—Plans for the proposed local mill of the B. F. Goodrich Rubber Company, Akron, Ohio, to cost about $3,000,000, include a power plant.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has applied for permission to erect a transmission line across San Diego Bay, between San Diego and Coronado.

SALT LAKE CITY, UTAH—The United Electric Supply Company has filed plans for an electric lighting station at 107 West Fourth Street.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 3, 1927)

1,627,168. ELECTRICAL TRANSMITTER; H. C. Ford, Jamaica, N. Y. App. filed July 3, 1918. Adapted to be used with step-by-step transmission signal systems.

1,627,188. MACHINE FOR WINDING RESISTANCE COILS; E. N. Lightfoot, New York, N. Y. App. filed April 14, 1920.

1,627,213. WINDING MACHINE; D. Stone, New Rochelle, N. Y. App. filed March 25, 1922.

1,627,238. ELECTRIC SOCKET STRUCTURE; M. Herskovitz, Chicago, Ill. App. filed May 23, 1919.

1,627,264. ELECTRIC LANTERN BATTERY; F. T. Baird, Blue Island, Ill. App. filed Sept. 4, 1923.

1,627,286. CORD CONNECTER; W. Ile, Jackson, Mich. App. filed May 6, 1926.

1,627,304. ELECTRIC SWITCH; C. E. Anderson, Stratford, Conn. App. filed Sept. 11, 1923. Of the hill and valley type for lamp sockets.

1,627,306. ELECTRIC CONNECTER; J. Berg, Chicago, Ill App. filed Aug. 31, 1921. For low-voltage miniature lamps.

1,627,322. ELECTRICAL RELAY; R. M. Gilson, Pittsburgh, Pa. App. filed Nov. 29, 1922. For use in signaling systems.

1,627,326. FREQUENCY-CHANGING AGGREGATE; R. E. Hellmund, Swissvale, Pa. App. filed Aug. 6, 1923. To provide combinations of a plurality of induction machines of different pole numbers adapted to exchange electrical energy between electrical systems operating on several frequencies.

1,627,330. VARIABLE-SPEED SQUIRREL-CAGE MOTOR; H. D. Hineline, Akron, Ohio. App. filed June 16, 1922. A system for operating an induction-motor aggregate at variable speeds.

1,627,334. DRY CELL; G. M. Little, Pittsburgh, Pa., and J. G. Ford, Wilkinsburg, Pa. App. filed Dec. 21, 1923. Will not deteriorate rapidly when it is not in use.

1,627,340. CONTROL APPARATUS; L. G. Riley, J. M. van Nieukerken and H. R. Meyer, Wilkinsburg, Pa., and H. H. Johnston, Edgewood Park, Pa. App. filed May 17, 1920. Attachments for platform controllers of the "K" type for electric railway vehicles.

1,627,345. TRANSFER SWITCH; V. W. Sherman, Detroit, Mich. App. filed April 20, 1926. For use in conjunction with radio sending and receiving apparatus for controlling the energization of the respective apparatus and the connection therewith with the antenna.

1,627,352. BONDING RAILS; G. E. Thackray, Westmont Borough, Pa. App. filed April 14, 1921. Flexible bond the terminals of which are fused or welded to the upper surface of the base flanges of the rails.

1,627,357. ELECTRIC CIRCUIT CONTROLLING APPARATUS; Kansas City, Mo. App. filed Jan. 14, 1924. In which circuit is controlled by a key-operated bolt of a door.

1,627,442. BATTERY CONNECTER; J. O. Luthy, San Antonio, Tex. App. filed June 7, 1924. For quick and effective application to the terminals or conducting elements of storage batteries or other electrical apparatus.

1,627,447. COMBINATION TERMINAL; J. J. Mucher, Brooklyn, N. Y. App. filed July 23, 1924. Spring terminal which may be readily mounted on a carbon stick and held firmly in operative position.

1,627,461. LIGHTING FIXTURE; G. P. Robinson, Summit, and W. T. Blackwell, Westfield, N. J. App. filed June 7, 1924. For use upon the ceilings of kitchens, corridors and porches.

1,627,493. ELECTRICAL CONDENSER; W. Dubilier, New Rochelle, N. Y. App. filed Feb. 28, 1925. Fixed type of constant electrostatic capacity.

1,627,519. THERMAL SWITCH; R. C. Malcom, Wichita, Kan. App. filed May 10, 1926. For closing a circuit through signal devices.

(Issued May 10, 1927)

1,627,593. MOTOR CONTROLLER; D. H. Chason, Elizabeth, N. J. App. filed Jan. 12, 1923. Of the foot-operated type and as is used with sewing machine motors.

1,627,594. ELECTRIC PLUG; W. H. Clark, Chicago, Ill. App. filed April 3, 1922. Of the quickly removable type for insertion in a screw socket.

1,627,631. ELECTRIC LAMP SOCKET; W. G. Chizlett, Oroville, Cal. App. filed July 23, 1926. For quick attachment to a pair of wires without necessitating the removal of the insulation or the permanent attachment of the socket to the wires.

1,627,685. SIGNALING SYSTEM; C. E. Beach, Binghamton, N. Y. App. filed Oct. 23, 1923. For automatic fire-alarm service.

1,627,701. SYSTEM FOR TRANSMITTING AND REPRODUCING PICTURES; M. C. Hall, New York. App. filed Dec. 20, 1923.

1,627,732. THERMOSTATIC CONTROL FOR ELECTRIC OVENS AND THE LIKE; E. L. Fonseca, Newark, N. J. App. filed Sept. 11, 1924.

1,627,816. THERMAL LIMIT RELAY; G. H. Whittingham, Baltimore, Md. App. filed April 16, 1925. For use with alternating-current electric motors.

1,627,821. ELECTROMAGNET; C. D. Ainsworth, Wollaston, Mass. App. filed Sept. 1, 1922. Of the ironclad solenoid type.

1,627,828. AUTOMATIC SAFETY BREAKER; L. A. Brown, Uniontown, Pa. App. filed Nov. 6, 1925. For direct-current electrically driven machinery, particularly useful in connection with mine gathering locomotives and other mine machinery.

1,627,832. SPEED REGULATION; C. E. Carpenter, New York, N. Y. App. filed Aug. 24, 1921. For motors driving paper-making machinery.

1,627,875. ELECTRIC WATER HEATER; J. J. Underwood, Tacoma, Wash. App. filed Aug. 20, 1925. For domestic use, in which the heating element is immersed in the water being heated.

1,627,893. FURNACE REGULATION; G. H. Gibson, Montclair, N. J. App. filed March 5, 1923. For regulating combustion in furnaces of a power plant in which all, or practically all, of the steam generated is utilized in generating electricity.

1,627,895. SIGNAL LANTERN AND LENS THEREFOR; A. H. Handlan, St. Louis, Mo. App. filed Jan. 15, 1925.

1,627,896. NO-FLOW ALARM-CIRCUIT CLOSER; R. E. Hanson, Los Angeles, Cal. App. filed April 29, 1926. For sounding an alarm when the flow in a pipe-line system ceases.

1,627,922. FLATIRON; J. W. Myers, Jackson, Mich. App. filed March 24, 1924. With temperature automatically maintained.

1,627,942. AUTOMATIC GENERATING PLANT; T. S. Watson, Milwaukee, Wis. App. filed June 12, 1922. For farm-lighting plants.

1,627,949. ELECTRIC MOTOR; E. N. Baker, Springfield, Ohio. App. filed July 14, 1924. Single-phase induction motors of the split-phase type.

1,627,962. CIRCUIT CLOSER; J. A. Fiebiger, St. Paul, Minn. App. filed Dec. 16, 1925. Burglar-alarm mechanism.

1,627,993. ELECTRIC SIGN; J. Pedersen, St. Louis, Mo. App. filed Feb. 27, 1926.

1,628,003. FLOAT-OPERATED SWITCH; E. B. Smith, Tampa, Fla. App. filed Feb. 7, 1922.

1,628,077. METHOD AND SYSTEM OF VIBRATORY SIGNAL CONTROL; J. P. Tarbox, Garden City, N. Y. App. filed April 10, 1917.

1,628,079. DOUBLE-CIRCUIT STARTING AND GENERATING SYSTEM; W. A. Turbayne, Niagara Falls, N. Y. App. filed Feb. 3, 1921. Storage-battery-generating lighting plant.

1,628,086. ELECTRICAL APPARATUS; C. Warner, Dayton, Ohio. App. filed Nov. 15, 1923. Cooling apparatus for electric motors comprising fans and arranged duct system.

1,628,104. PROCESS OF MAKING SEPARATORS AND SEPARATOR STOCK; R. C. Benner, Bayside, N. Y. App. filed March 28, 1923. For storage batteries.

1,628,148. ARC-WELDING MACHINE; G. C. Hubble, Bonners Ferry, Idaho. App. filed March 20, 1926.

1,628,191. DOUBLE-POLE, TWO-WAY PUSH-BUTTON SWITCH; J. J. Rattay, McKeesport, Pa. App. filed Feb. 18, 1922.

1,628,202. ELECTRIC BRAKE; O. F. Shepard, Cincinnati, Ohio. App. filed Jan. 15, 1924.

1,628,222. AUTOMATIC SWITCH FOR ELECTRIC LIGHTS; A. Berth, Sheboygan, Wis. App. filed April 25, 1923. Door-operated.

1,628,241. INSULATOR; W. T. Goddard, Hamilton, Ontario, Canada. App. filed Oct. 1, 1921. Means for connecting the adjacent sections of a post insulator.

1,628,256. NEON TUBE; R. R. Machlett, New York, N. Y. App. filed Oct. 16, 1926.

1,628,367. BELL; A. F. Lake, Oakland, Cal. App. filed Jan. 2, 1926. Single-stroke alternating-current bell.

1,628,375. APPARATUS FOR REFINING METALS; M. Unger, Pittsfield, Mass. App. filed Dec. 31, 1925. For the production and refining of silicon steel.

1,628,376. ELECTRIC FURNACE; I. R. Valentine, Erie, Pa. App. filed Feb. 26, 1925. Operating at high current density.

1,628,379. AUTOMATIC CONTROL SYSTEM; F. P. Whitaker, Rugby, England. App. filed June 9, 1925. For starting and obtaining the correct polarity at the direct-current terminals of a motor-started, self-synchronizing rotary converter.

1,628,399. RECEPTACLE FOR CONNECTING PLUGS; G. Frankel, Chicago, Ill. App. field Sept. 22, 1921.

1,628,402. MOTOR-CONTROL SYSTEM; W. S. Hamilton, Schenectady, N. Y. App. filed May 16, 1925. For motors which are operated as load-driven generators to brake the load.

1,628,405. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed June 23, 1922. Oil circuit breaker; means for preventing burning at the contacts when the switch is closed under load.

1,628,406. SERVICE SWITCH AND APPURTENANT PROTECTIVE FITTING; B. D. Horton, Detroit, Mich. App. filed March 26, 1919.

1,628,409. CONTROL SYSTEM FOR ELECTRIC MOTORS; C. A. Kelsey, Schenectady, N. Y. App. filed Oct. 15, 1925. For accurate speed regulation of a driven load.

1,628,415. ELECTRIC KEY SOCKET; C. S. Mallett and W. J. Aldis, Toronto, Ontario, Canada. App. filed May 7, 1925.

1,628,425. CONTROL OF DYNAMO-ELECTRIC MACHINES; A. A. Pollock, Leamington Spa, England. App. filed Sept. 28, 1926. Water-wheel-driven direct-current units operating in parallel.

1,628,438. CABLE JOINT; D. M. Simons, Osborne, Pa. App. filed Jan. 3, 1925.

1,628,444. INDICATING APPARATUS; W. C. White, Schenectady, N. Y. App. filed Feb. 27, 1923. For producing a visible indication of electrical variations of too short duration to be directly observed in ordinary measuring instruments.

1,628,448. ELECTRIC SWITCH; W. A. Atwood, Schenectady, N. Y. App. filed April 21, 1924. To be used as auxiliaries in the control of circuit breakers.

1,628,450. TELEMETRIC APPARATUS; W. P. Blanchard, Winthrop, Mass. App. filed Dec. 4, 1924.

1,628,456. METAL FILAMENT; T. E. Foulke, Cleveland, Ohio. App. filed July 29, 1922. For incandescent lamps.

1,628,463. MEANS FOR REPRODUCING RELATIVE ANGULAR MOTION; E. M. Hewlett and W. W. Willard, Schenectady, N. Y. App. filed Jan. 4, 1922.

1,628,464. INDUCTION MACHINE; H. M. Hobart, Schenectady, N. Y. App. filed Aug. 24, 1923. Cascade connection for induction motors. The elimination of all slip rings on induction motors connected in cascade.

1,628,480. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed April 13, 1922. Quick-make-and-break type adapted to control lighting circuits; adaptable to key socket.

1,628,493. ELECTRIC SIGNALING SYSTEM; J. T. Donahoe, Chicago, Ill. App. filed Aug. 13, 1925. For street-railway cars.

1,628,536. AUTOMATIC SAFETY TROLLEY; P. Fasson, Mount Pleasant, Pa. App. filed April 30, 1925.

1,628,547. FIRE-ALARM APPARATUS; C. E. Koontz, Baltimore, Md. App. filed March 3, 1923.

1,628,611, 1,628,612, 1,628,613. DYNAMO-ELECTRIC MACHINE AND WINDING THEREFOR; W. H. Powell, Milwaukee, Wis. Apps. filed May 16, 1924, June 21 and July 29, 1926. In which the currents in the various armature paths will be equalized without the use of cross-connectors.

1,628,627. ELECTRICAL STRUCTURE; W. Dubilier, New York, N. Y. App. filed June 30, 1923. High-potential condenser structures.

1,628,636. ELECTRIC CIRCUIT-CLOSING PLUG; F. Dominick, New York, N. Y. App. filed April 23, 1921.

(Issued May 17, 1927)

1,628,683. ELECTRIC CONTACT PLUG; E. C. Penin, Joinville-le-Pont, France. App. filed Nov. 8, 1924. For domestic motion-pjicture apparatus.

1,628,756. SIGNALING DEVICE; C. Taylor, Washington, D. C. App. filed Jan. 12, 1923. For use in controlling vehicular and railway traffic.

1,628,784. ELECTRIC VAPORIZER; M. Katzman, Ogdensburg, N. Y. App. filed May 25, 1926. For medicinal, sterlizing, odorizing or deodorizing purposes.

1,628,785. ELECTROLYTIC RECTIFIER; L. J. Keeler, Cleveland, Ohio. App. filed Jan. 18, 1926. For converting an alternating current into a direct current.

1,628,808. AUTOMATIC RECIPROCATING BOLT; E. Ruff and E. C. Bailey, Newark, N. J. App. filed July 8, 1926. For fastening doors.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Large Systems and Small

GROWTH is an attribute of life. In the human being, at first chiefly physical and in later years continued in the realm of the spiritual and the intellectual, its cessation marks the beginning of stagnation and decay. In our Western civilization as at present constituted the same statement would seem to apply to human organizations as to individuals.

Where these relate to physical development the reason for the observed growth can often be readily explained. Thus in the manufacture, distribution and application of electrical energy to diverse human needs, great base-load steam stations and hydro-electric plants harnessing large streams, interconnected over an entire geographical region, can serve their territory more efficiently, more economically, more certainly and with greater prospects for promoting industrial development than would be possible with a large number of unrelated isolated plants. The tendency toward concentration, noted in past years, is therefore bound to continue. But it is far from being completed.

To say that 84 per cent of the central-station energy generated in the United States comes from systems having an output exceeding 100,000,000 kw.-hr. per year is one way of putting it; to say that the energy generated by companies of smaller size is equal to the entire output of the industry fifteen years ago is another way of looking at it. Moreover, many of these large systems in themselves comprehend numerous interconnected operating units, ordinarily listed as separate companies, and properly so. A conclusion drawn from a comparison merely of the total number of major operating systems with a total number of companies in the country would therefore be highly misleading. In many instances wide latitude is given to the local managements, though physically the operations are welded into a single entity.

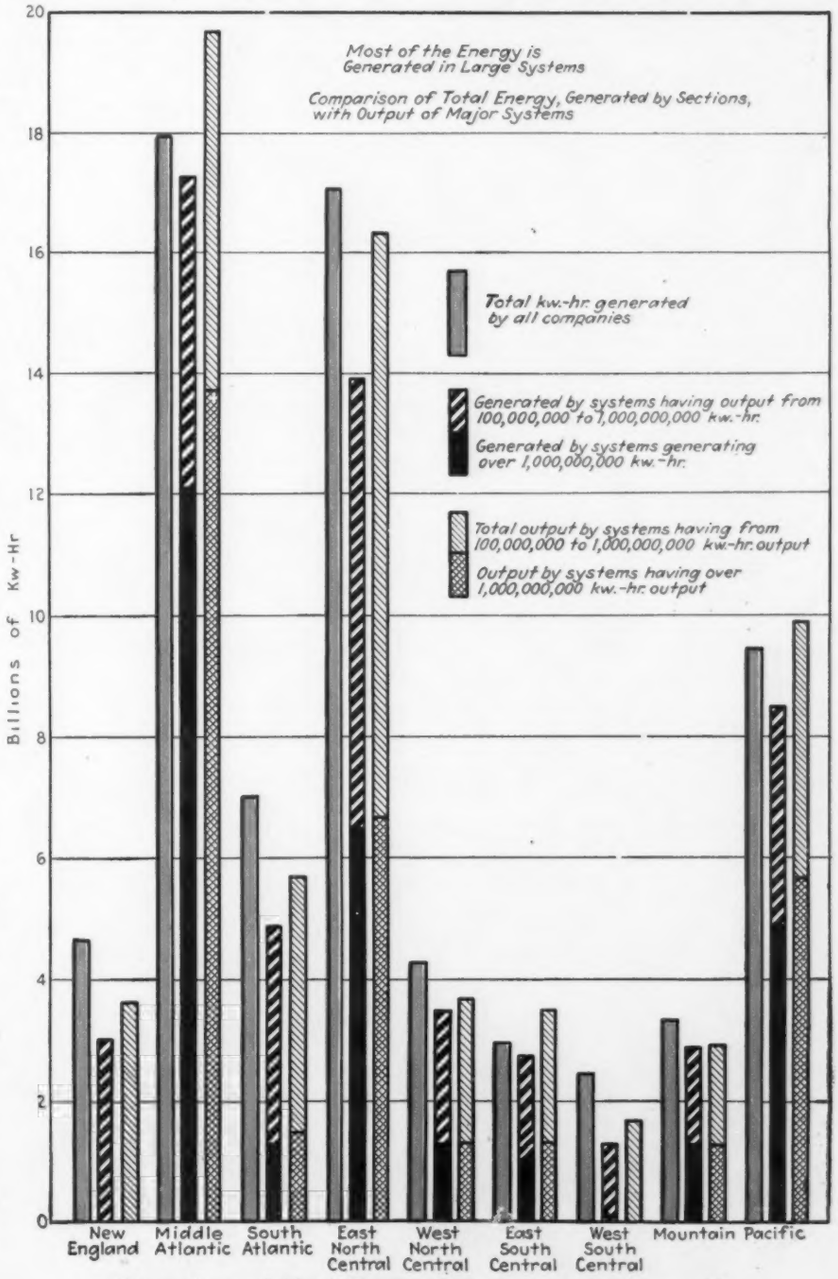
The tendency toward concentration is most notable in the Middle Atlantic States. The Niagara region alone accounts for 20 per cent of all the energy generated in that group of states. New York City, northern New Jersey, Philadelphia, the Pittsburgh district and the busy chain of cities along the line of the old Erie Canal together constitute a group of industrial centers of enormous power consumption.

New England, notwithstanding its interconnections, still has a third of its energy generated in the smaller systems. And despite its recent rapid economic progress the same thing may be said of the South Atlantic section. Even in the great industrial states of the East North Central division more than 3,500,000,000 kw.-hr. comes from the smaller companies. In the East South Central section the percentage from the big system runs higher. The Southwest is still dotted with many companies of moderate size, while the West is more highly unified.

In constructing the chart an allocation has been made between the South Atlantic and East South Central States of the operations of one large system serving both territories but necessarily listed under the latter in the published statistics (ELECTRICAL WORLD, April 30, 1927) as the one embracing the greater part of its activities.

In every section of the country the interchange of energy between the major systems and their neighbors, large and small, is considerable. It is least in the Mountain States—about 100,000,000 kw.-hr.—and greatest in the East Central and Middle Atlantic States, in each of which it approaches 2,500,000,000 kw.-hr. annually.

With the exception of New England and the Southwest, each section has one or more systems with an annual output of a billion kilowatt-hours. The Middle Atlantic States lead, with seven.



Comparison of Total Energy Generated, by Sections, with Output of Major Systems

Production in North Central States on a Par with 1926

THAT the manufacturing plants of the North Central States were operating in March and April at virtually the same high rate of activity as that recorded during the same months of last year is indicated by reports of the monthly consumption of electrical energy furnished the ELECTRICAL WORLD by some 400 manufacturing plants operating in this section and in various industries. Actual production in these plants during April was 2.3 per cent under March, but after corrections are made for the number of working days during the two months it is found that the productive activity during April was about 2.5 per cent over that of March. Production during April was practically the same as that reported for April of last year.

During the four months' period from October to March the industrial production in this section was considerably below that reported for the same months of the year previous. With March, however, the production rose to approximately the level reached in March of last year, and the April production continued at the same level as that reported for the same month of last year. There is every reason to believe that the general production of the manufacturing plants in this section of the nation will continue during the coming summer months on a par with that reported for the same period of 1926. That the production during the remainder of the year will rise above that of the year before seems unlikely, in view of the improbability of a further expansion in the building and automobile industries. On the other hand, that it will fall materially below last year is equally unlikely as long as credit supplies continue in their present abundance.

Production in the automobile manufacturing plants continued to increase, the April production being the largest ever recorded in this section. This rapid upward trend has continued since December, in which month was recorded the lowest automobile production of any month since the opening of 1922. It is probable that April recorded the peak of automobile production for this year.

The metal industries, which include both ferrous and non-ferrous working plants, decreased their production slightly during April, but the rate of production was about the same as that reported for March. These plants were operating materially above last year during both March and April.

Both the paper and pulp and the lumber industries of this section have been operating at a high rate of activity for the past sixteen months. A high rate of production as compared with the period 1923-1925 will probably continue in the paper and pulp industry, due largely to the natural growth in the demand for paper. In the lumber industry, however, the probabilities are that, due to the elimination of the housing shortage, the future demand for lumber will be below that for the past two or three years.

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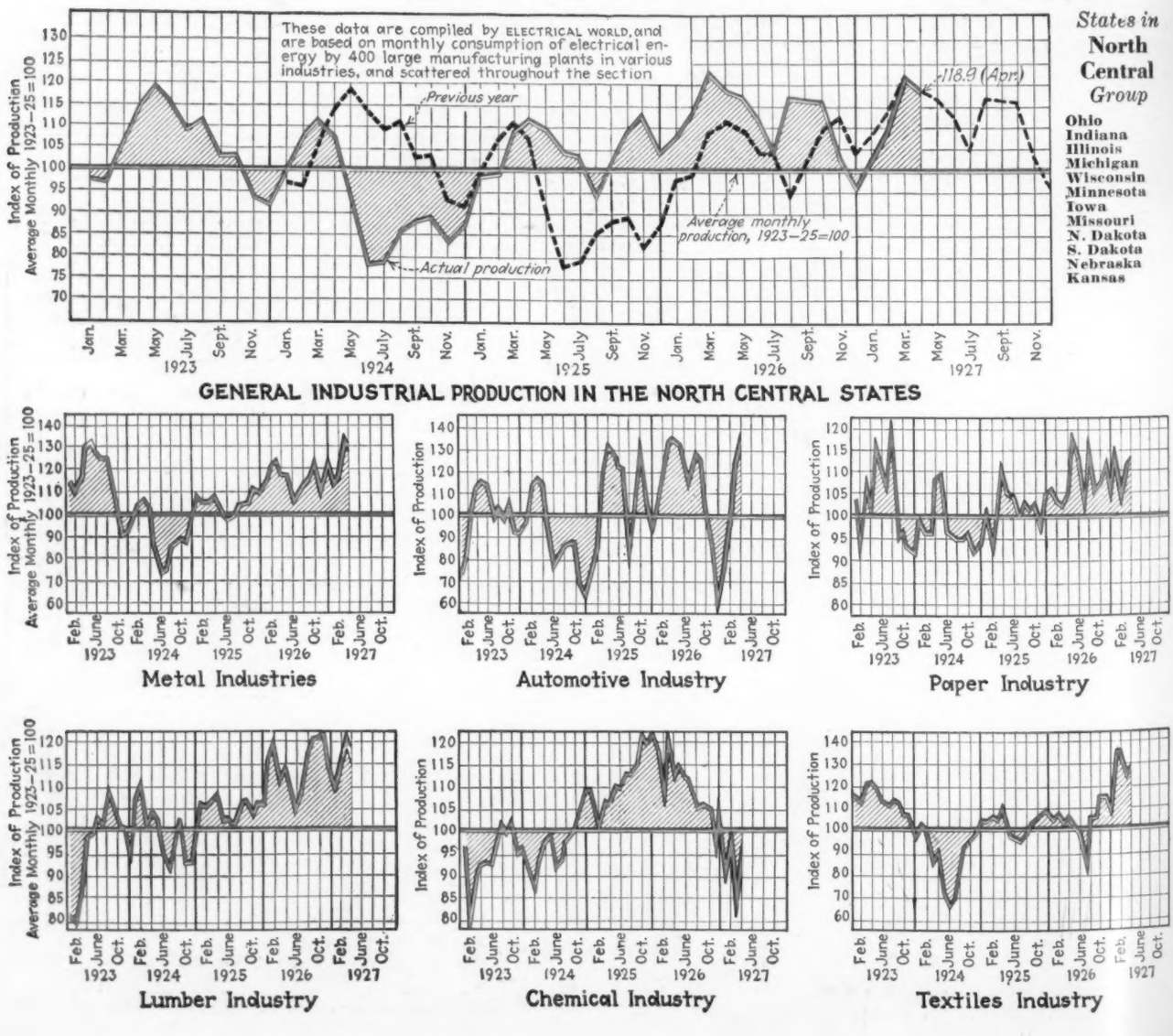
"Electrical World" Barometer of Industrial Activity in the North Central States

(Data Unadjusted for Seasonal Variation)